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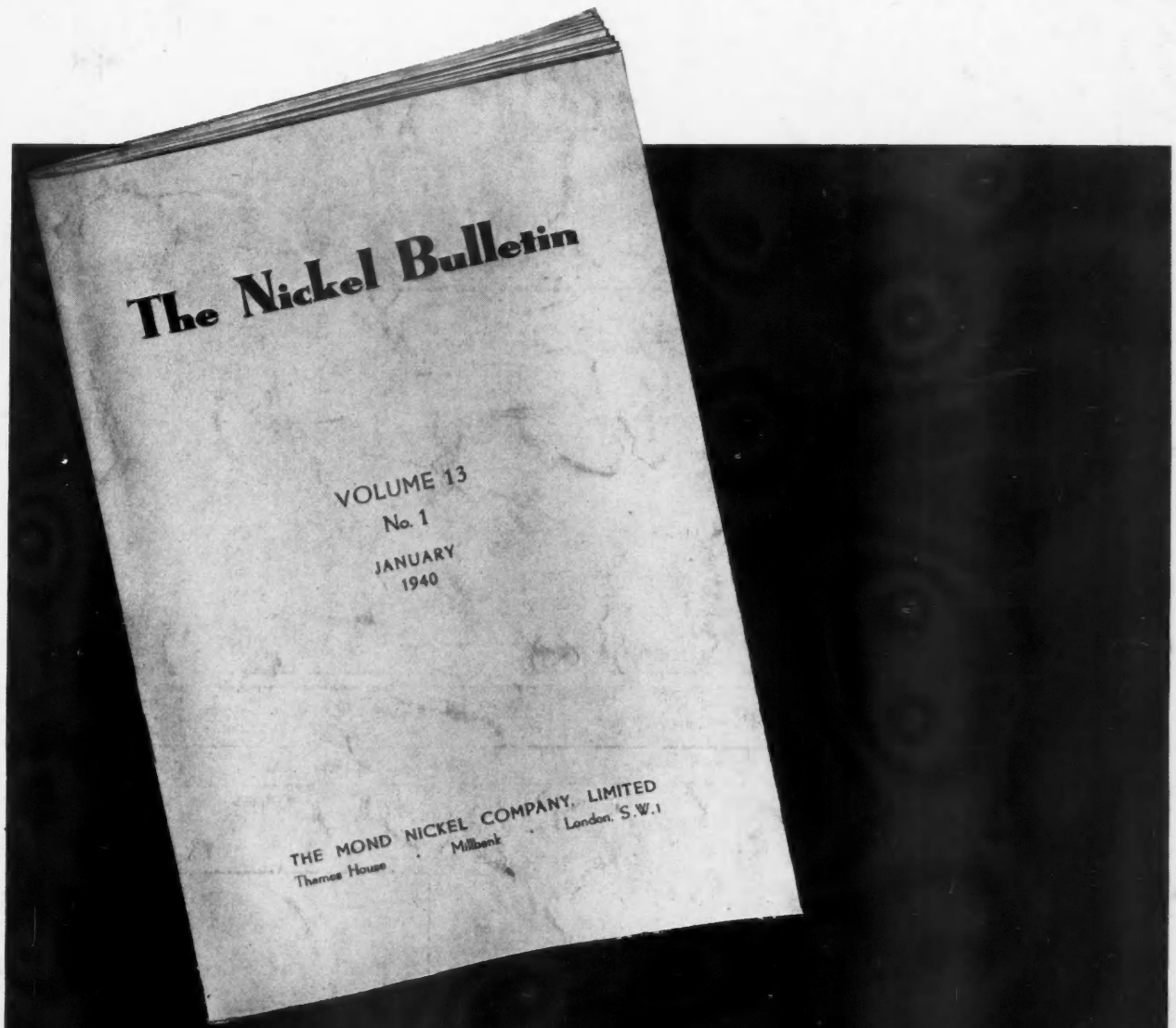

This monthly publication contains abstracts of all technical literature dealing with nickel and its alloys.

For reasons of economy it has been necessary to reduce the number of copies distributed but the Bulletin is still being sent to every reader who has a use for it and who cannot obtain access to another copy.

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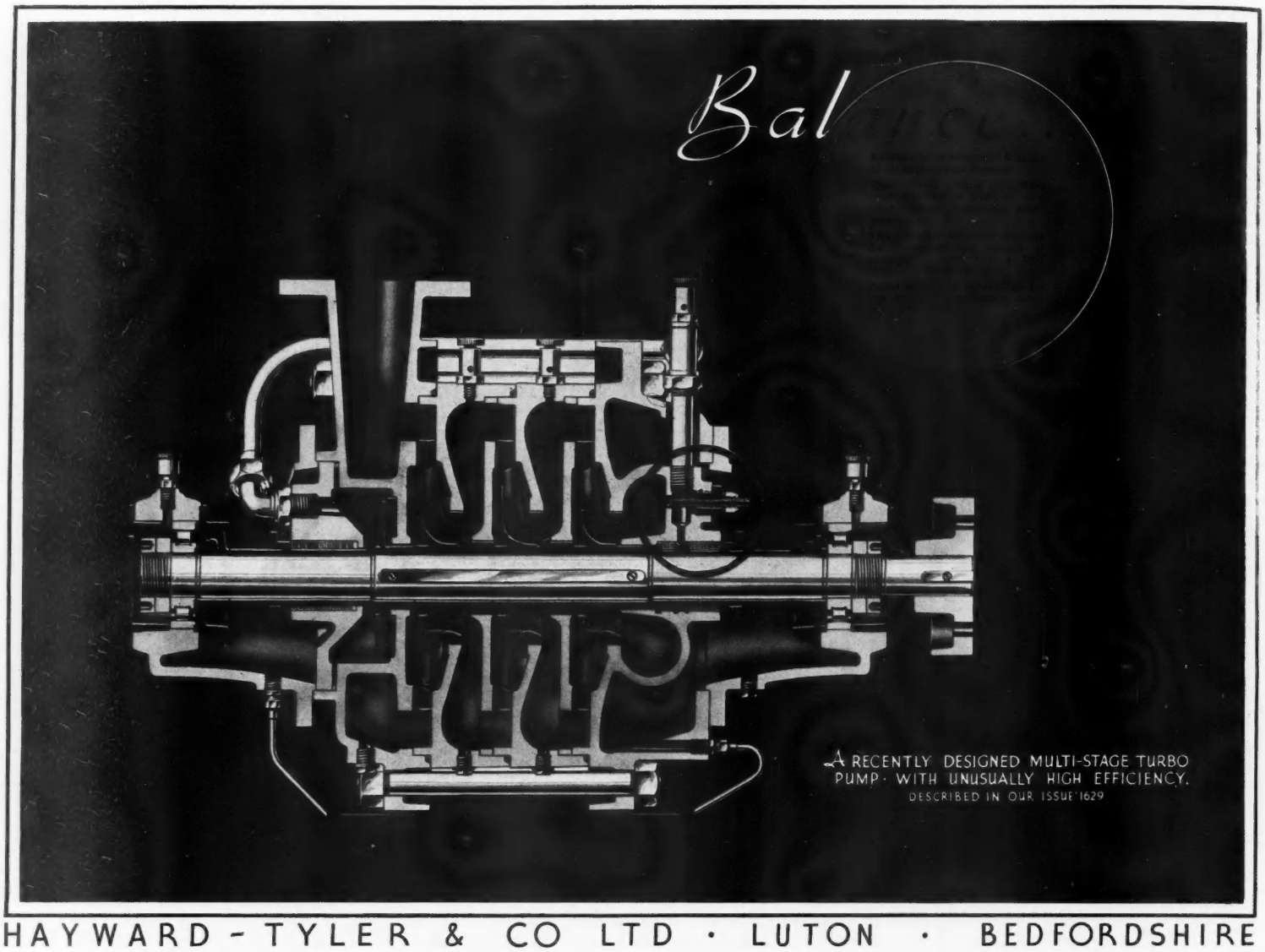

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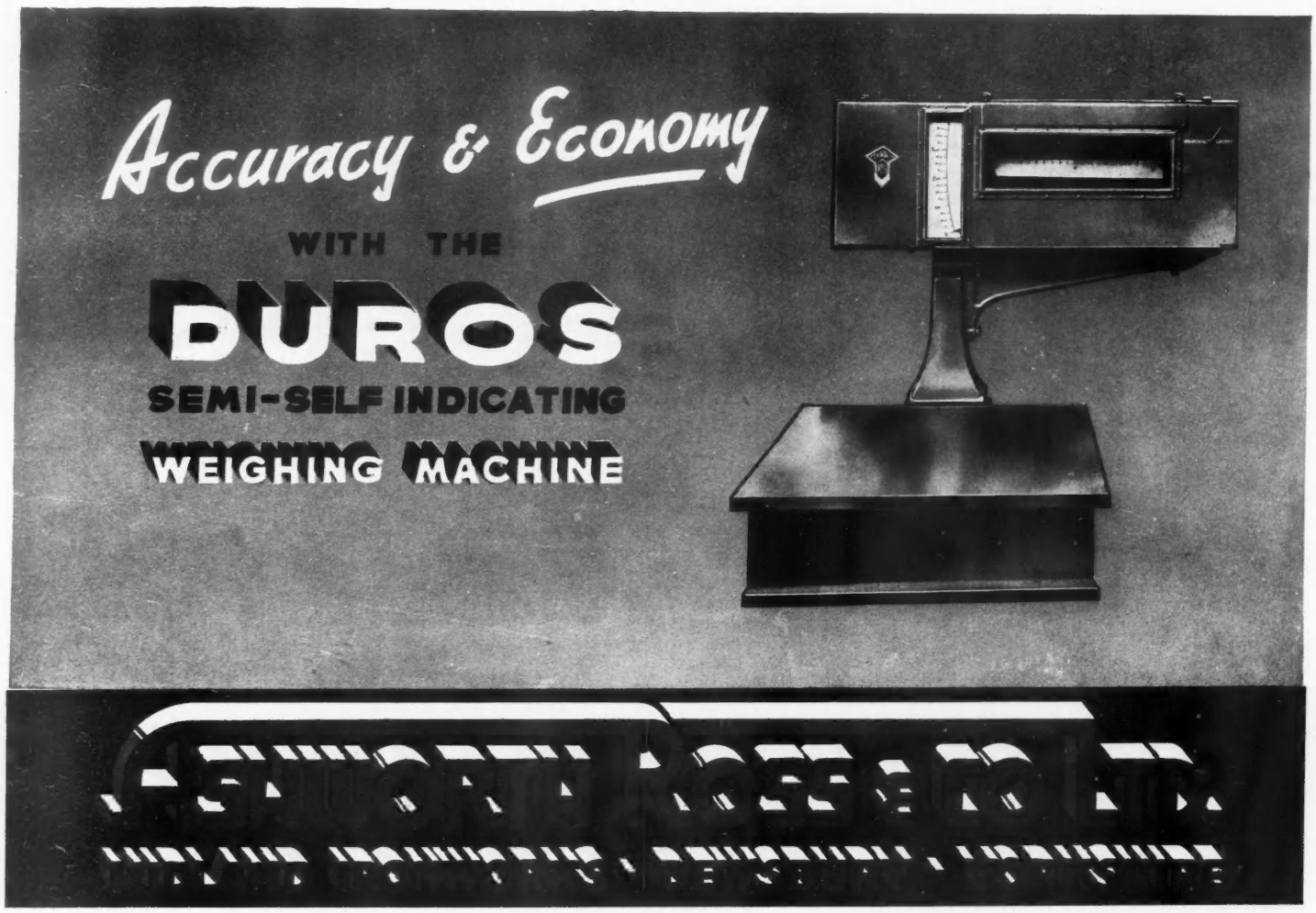


A Seven-Day Journal

War Contracts

ON Thursday of last week, January 4th, small manufacturers throughout the country who are anxious to obtain a share of war contracts met at the Holborn Restaurant, London, W.C. They unanimously resolved to form the Federation of Manufacturers and Producers of Great Britain, Ltd., for the purpose of promoting the cause and furthering the interests of the smaller manufacturers and producers of Great Britain and the British Empire. Mr. J. A. R. McDonald, who presided, said that about 1800 letters which had reached him showed that there was a desire that the Minister of Supply should be pressed to consider the interests of the small manufacturers. The Minister had said that he would give the small manufacturers 10 per cent. of the Government contracts, but the small contractors deserved more than that amount. The meeting of about 1200 representatives of small firms represented about £20,000,000 of capital, and well over 500,000 employees. They wished the Minister to put his contracts out to tender. Mr. Vyvyan Adams, M.P. for West Leeds, remarked that the duration of the war depended on the measure of efficiency that France and Great Britain could organise. The work of the Ministry of Supply should be decentralised. He referred to contracts on a large scale, the price of the complete work of which had to carry three or four different classes of profits. If an organisation could persuade the Minister to order directly from smaller firms they could cut out two or three intermediate groups of profits. It was not to be wondered at that there were often long delays in delivery in cases where the contractor was considering whether it would be economical for him to let out particular items. It was stated at the meeting that manufacturers who wish to join the federation should communicate with Mr. G. Weavers, hon. secretary and treasurer, 5, Budge Row, London, E.C.4. As a result of a recent interview with the Minister of Supply on this subject, the Secretary of the London Chamber of Commerce has seen Lord Woolton, Director of Equipment and Stores, at the Ministry of Supply. It was ascertained that, so far as clothing items are concerned, a proportion of contracts is being deliberately given to the smaller concerns and that, in the case of the wood-working trade, special action has been taken to encourage the grouping of firms under the leadership of a parent firm for the purpose of tendering for contracts. The London Chamber of Commerce has already, in many instances, been instrumental in finding sub-contracting work for the smaller firms and will now direct its attention to the possibility of forming groups to tender directly for Ministry contracts.

The Employment Returns

IT is announced by the Secretary to the Ministry of Labour and National Service that on December 11th, the numbers of unemployed persons on the registers of employment exchanges in Great Britain were 1,170,798 wholly unemployed, 143,065 temporarily stopped, and 47,662 normally in casual employment, making a total of 1,361,525. This was 41,063 less than at November 13th, 1939, and 469,847 less than at December 12th, 1938. The total on December 11th, 1939, comprised 897,984 men, 35,418 boys, 377,168 women, and 50,995 girls. There were reductions between November 13th and December 11th in the numbers unemployed in the distributive trades, hotel and boarding house service, dock, harbour, &c., service; the cotton industry; printing and bookbinding; the entertainment, sport, &c. industries; motor cycle, cycle, and aircraft manufacture; engineering; shipbuilding and repairing; and the road transport and shipping services. On the other hand, unemployment increased for seasonal reasons in agriculture, horticulture, &c.; and in the building industry. There was also some increase, by reason of temporary causes, in the numbers suspended from work in the coalmining industry. In comparison with December 12th, 1938, the decreases in the numbers of insured persons aged between 16 and 64 unemployed on December 11th, 1939, in the engineering and allied industries are as follows:—Coalmining, 52,137; engineering, &c., 38,360; iron and steel, 36,096; public works contracting, 34,879; metal goods manufacture, 25,267; shipbuilding and repairing, 22,281; road transport, 11,749; textile bleaching, printing, dyeing, &c., 10,638; and railway service, 10,458.

Water Supplies and River Pollution

THE annual report of the Water Pollution Research Board for the year ended June 30th, 1939, was issued on January 5th by the Department of Scientific and Industrial Research. In an introductory statement the Board calls attention to the importance of adequate treatment of waters for public supply which are in any way liable to pollution, and of frequent collection of samples for chemical and bacteriological examination. These measures are especially necessary in war time when there are movements of larger numbers of people from one district to another. Research carried out under the supervision of the Board includes investigations on the treatment of water for domestic and industrial purposes, the treatment and disposal of sewage and trade effluents, and on problems of pollution of rivers. In the base-exchange process of water-softening, further work has been done on the examination of British minerals, and one of these minerals, a glauconitic sand, from a brick-works in Surrey, has been found to have a high base-exchange capacity, and appears to be a suitable raw material for a base-exchange zeolite for the treatment of water. Other work on the base-exchange process has included the investigation of the effect of temperature on the base-exchange capacity of materials. In the interests of public health, much work has been done on the corrosive action of water on metal, including lead, and one treatment evolved consists of passing the water through limestone, marble, or similar substances. An investigation on the bacteriology of freshwater lakes and streams was begun in May, 1938; this work is being carried out for the Board by the Freshwater Biological Association, and a laboratory has been specially equipped for the work at the Association's research station at Wray Castle, Ambleside. Preliminary work has indicated that fluctuations in the numbers of bacteria in the upper layers of water in Windermere can be correlated with the rainfall over the drainage area immediately before the samples are taken. The report also gives interesting details of its work in connection with trade effluents, particularly milk factory effluents, and the treatment and disposal of sewage by means of percolating filters in series and by the activated sludge process.

Suburban Train Lighting

IMPROVED lighting systems on London suburban passenger trains will be completed next March according to the railway companies. There has been much complaint by the public because of the tardy appearance of modified lighting, particularly on suburban trains; the delay, however, is ascribed partly to lack of materials and partly to the fact that extensive wartime and Christmas traffic has necessitated the keeping in service of the whole of the rolling stock since the modified form of lighting was sanctioned. The task of fitting the equipment is great, for there are 42,000 carriages operated by the main line companies with accommodation for 2,500,000 persons. Priority has been given to the long-distance trains, practically all of which have now been equipped. But for suburban carriages alone 150,000 light and shade fittings are still needed. The present lighting systems will not necessarily be permanent and other experiments are being undertaken by the technical staff of the railway companies. Government tests are being made in each district from ground level and from the air. The L.N.E.R. programme of suburban train lighting is nearly completed, and the work on main line and provincial trains is well in hand. Eighty-eight complete train sets have now been equipped with reading lighting, and on the main lines 400 out of 427 corridor coaches have been fitted with normal lighting. Other types of coaches in which full lighting cannot be installed will have the suburban device. Twenty suburban trains operated by the L.M.S. are equipped with improved lighting, but 1700 passenger vehicles still require equipment. Adaptation is being carried out at the rate of 450 carriages per week. The Southern Railway is not so well forward, for the experimental lighting at present in operation on three lines of the suburban services is still under consideration by the Home Office.

Resignation of the Chief Censor

ACCORDING to a Home Office announcement, Vice-Admiral Usborne, who has been Director of Censorship since the outbreak of war, has resigned his appointment in order to undertake new work of national importance for which his experience and service particularly qualify him in connection with specialised naval construction under contracts for the Admiralty. The Home Secretary has expressed his appreciation of the valuable services which Admiral Usborne has rendered in the initial organisation of the Censorship Division and in the conduct of the Division since his appointment. It is understood that Vice-Admiral Usborne will become joint managing director of a ship construction firm which is devoted entirely to work for the Government. He is a former head of Naval Intelligence and a gunnery expert, and has given the Navy three inventions—the paravane, a quick-firing anti-aircraft pom-pom gun, and an indicator to help the naval gunner. Speaking recently of his new work, which arose from an idea he had about a year ago, he said that what was then an idea is now a very big thing. He was connected with its initiation and he felt personally responsible for it being brought to a successful conclusion. The Director-General of the Press and Censorship Bureau has known for some time past that Admiral Usborne contemplated resigning his post in order to be free to undertake the work referred to, but Admiral Usborne has deferred taking the step until the moment when, in the opinion of the Director-General, the changes could be effected most conveniently and with the least interference with the work of the Censorship Division.

Scientific Workers for the Forces

A MINISTRY OF LABOUR and National Service announcement states that the operation of the Schedule of Reserved Occupations is being relaxed to enable men at or above the age of reservation in scientific occupations to volunteer in approved cases for service in the Forces. Such men have previously been able to join the Forces in their professional capacity, and the present relaxation of the Schedule is designed to enable those whose services are not required in a professional capacity in the Forces or as civilians to volunteer for other forms of service. To secure that scientific workers shall not be withdrawn from civil work to the detriment of the national interest, and that an adequate reserve of scientific workers is maintained for essential services, the Scientific Research Committee of the Central Register Advisory Council will consider applications from volunteers with a view to ensuring that relaxation is granted only in suitable cases. Any reserved scientific worker who wishes to volunteer should apply to the Ministry of Labour and National Service (National Service Department), Montagu House, Whitehall, London, S.W.1.

Motor Vehicle Lighting

THE Minister of Home Security proposes to make an amending lighting order under which it will be compulsory, from January 22nd, to use the official A.R.P. headlamp mask conforming to the regulations already issued, or a mask giving an equivalent performance. After that date it will be illegal to use any other type of mask. Owners of motor vehicles are therefore advised to obtain a mask of the new type and to see that it is properly fitted. In particular, steps must be taken to ensure that when the vehicle is standing on a level road no light from the masked headlamp can be seen at or above the horizontal. The mask may be fitted either to the off-side or the near-side headlamp. At the same time the Minister calls the attention of owners of vehicles to the necessity of screening side-lights and rear lights correctly. In this connection, the Minister proposes to insert in the new order an additional requirement that, except in the case of certain public service vehicles, the rear lamp must be carried at a height not exceeding 3ft. 6in. above ground level. Recent reports of air observation have shown that the lights at present in use are in many cases too bright and are unduly visible from the air. The A.R.P. headlamp mask and full details of the correct method of screening sidelamps and rear lamps are given in the Air Raid Precautions Department pamphlet on War-Time Lighting Restrictions for Road Vehicles, issued last October.

The New Iron and Steel Controller

ON Wednesday, January 10th, it was officially announced that Mr. Leslie Burgin, the Minister of Supply, had appointed Colonel Sir William Charles Wright to be Controller of Iron and Steel in place of Sir Andrew Duncan who has recently been appointed President of the Board of Trade. Sir Charles Wright is the chairman of Baldwins, Ltd., Guest, Keen, Baldwins Iron and Steel Company, Ltd., and other companies, and we may recall that on the outbreak of war he ceased active participation in these companies in order to take up the office of Deputy Controller of Iron and Steel. Sir Charles is eminently fitted to carry on the important task to which he has now been called, for he held similar office during the last war, and has since been in close touch with the immediate post-war and the following developments of the iron and steel industry. From 1917–1919 he served in the Ministry of Munitions as Controller of Iron and Steel production. During recent years Sir Charles has held high office in the industry. From 1931–1933 he was President of the Iron and Steel Institute, while from 1937–1938 he was President of the British Iron and Steel Federation. His services to the nation and industry were recognised by the conferring of the honours C.B. in 1918, second baronet, and K.B.E. in 1920. He is also an officer of the Legion of Honour of France and a Knight Commander of the Crown of Italy.

H

Roads, Bridges, and Tunnels in 1939

No. II

(*Continued from page 24, Jan. 5th*)

Asia

IN Baghdad, two new road bridges have been under construction for the Government of Iraq since October, 1936. One of these, the North Bridge, was formally opened to traffic on July 15th, 1939. The two bridges are known respectively as the "North Bridge" and the "King Feisal Bridge." The North Bridge is 706ft. in length and has five spans varying in width from 122ft. to 171ft. and is situated close to the site of the Kotah Bridge. The King Feisal Bridge, which is now approaching completion, is being built on the site of the Maude Bridge approximately 1000 yards downstream from the North Bridge. It is 980ft. in length, having seven spans of dimensions similar to the North Bridge, and in both cases the smaller spans are situated at the shore ends. Both the Kotah and Maude bridges were pontoon bridges and are no longer considered adequate for present traffic requirements, only one way traffic being allowed.

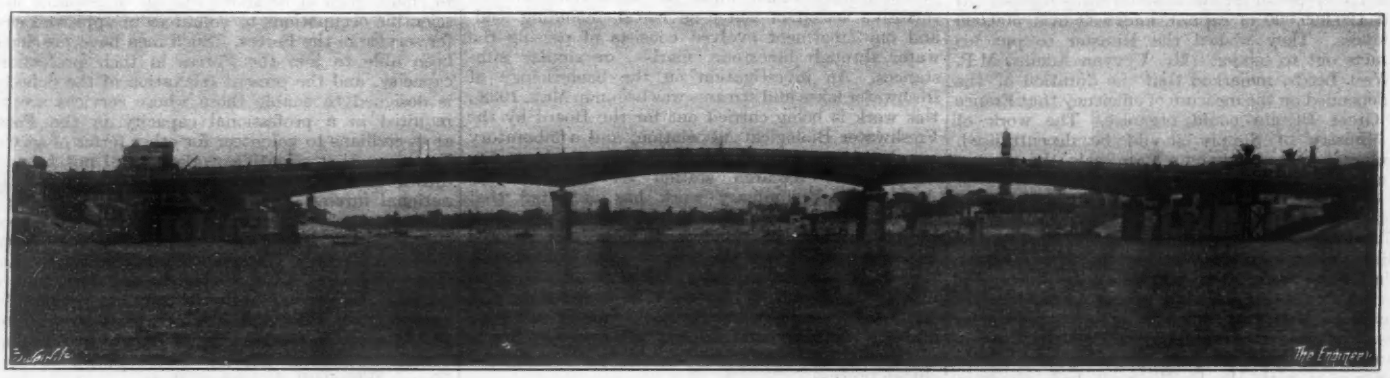
The bridges have been designed for heavy road traffic conformable to the recommendations of the British Ministry of Transport. Each bridge has a roadway 29ft. 6in. in width between curbs and two footways each of 10ft. width. Roadways and side walks are supported by pressed steel flooring carried on cross girders between and cantilevered from two main girders. The latter span between piers and extend as cantilever arms on either side into the adjacent spans. The gaps thus formed between the ends of the cantilever arms in bays adjacent to the main girders are bridged by suspended girders. The superstructure is built upon masonry piers and abutments of which the foundations are caissons, sunk under pneumatic pressure, into the bed of the river. The caissons are founded at approximately 60ft. below low-river level and the tops of the piers are approximately 90ft. above their foundations.

During high flood the Tigris at Baghdad rises rapidly by an amount often exceeding 20ft. To obviate risk of damage during flood the contractors' erection programme provided for the assembly of the main girders on shore, and for floating them into position between the piers when the state of the river was suitable. Subsequent to this operation, the cross girders and remaining superstructure were erected over the river upon the main girders; there was, therefore, no temporary staging required in the river for these operations.

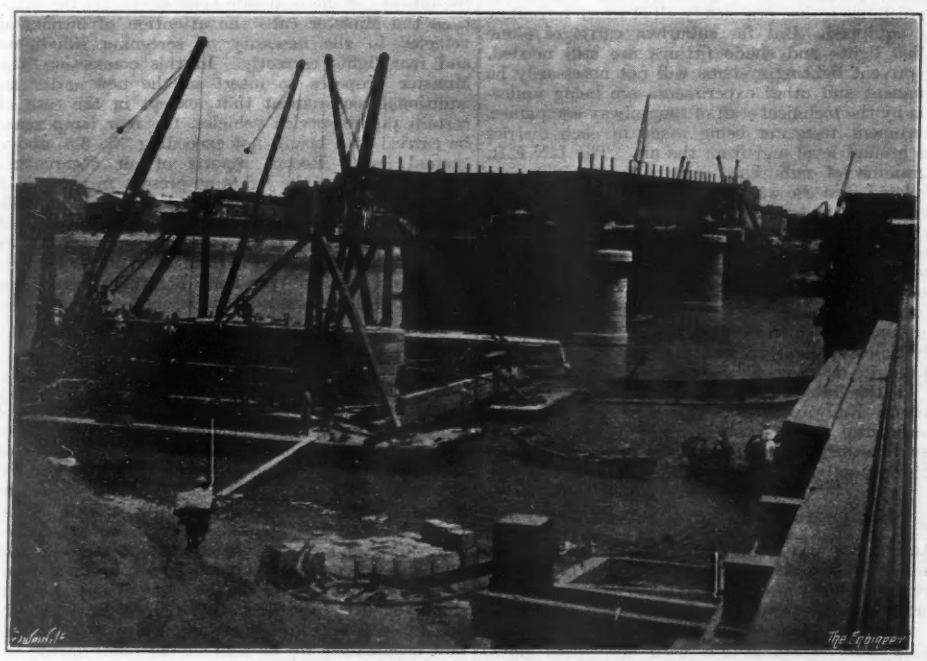
The erection of these bridges is being carried out by Holloway Brothers (London), Ltd., under contract to the Government of Iraq. The bridge steelwork was prepared in England by Braithwaite and Co. (Engineers), Ltd., of West Bromwich, in the capacity of sub-contractors. The contract sum is approximately £360,000 for the two bridges. The contractors have also been entrusted with the work of constructing the ramped approaches to each bridge, and with the reinstatement and reconditioning of the river walls adjacent to the bridges. These additional works are approximately of the value of £39,000.

The work throughout has been to the designs and under the supervision of Messrs. Coode, Wilson, Mitchell, and Vaughan-Lee acting as consultant engineers to the Government of Iraq.

Usually in these articles we refer only to works of some considerable magnitude. But there is now a comparatively minor work approaching completion in India that deserves mention, on account of the remoteness of the area in which it is being carried out and its own unusual character. Connection is maintained between Katmandu in the Kingdom of Nepal and Bihar Raxaul in India by a railway from the latter place to Amlekgange, thence by road in a mountainous district to Bhimphedi, by ropeway over two mountain ranges, and finally by metalled road to Katmandu. About six miles from the railhead at Amlekgange the road passes in a tunnel at a height of about 2500ft. through the Churia ridge. This tunnel was constructed in 1926 and is about 1200ft. long; and its dimensions are only just sufficient for a single motor lorry to pass through. As originally constructed it was lined with sal timber which has begun to rot. The Nepal Government referred the matter to its consulting engineers, Messrs. Williams, Temple and Bartholomew of Westminster, who were required to devise a scheme of improvement which, without interrupting lorry traffic for more than a few hours at a time, would make the tunnel secure for the future. On consideration it was decided to leave the timber lining in place, but to supplement it by reinforced concrete panels at the sides, to construct a reinforced concrete roof, and to lower the floor in order to increase the headroom. Drawings show cross sections of the tunnel before and after alteration. Owing to the fact that between the middle of March and the end of December the local water supply fails altogether, the working season is very short. During 1939 the sidewalls and floor were completed for the whole length of the tunnel, and several hundred feet of arch was completed. The remainder of the work will be done in the present season.



NORTH BRIDGE OVER THE RIVER TIGRIS AT BAGHDAD



KING FEISAL BRIDGE, BAGHDAD—JULY 25TH, 1939

Africa

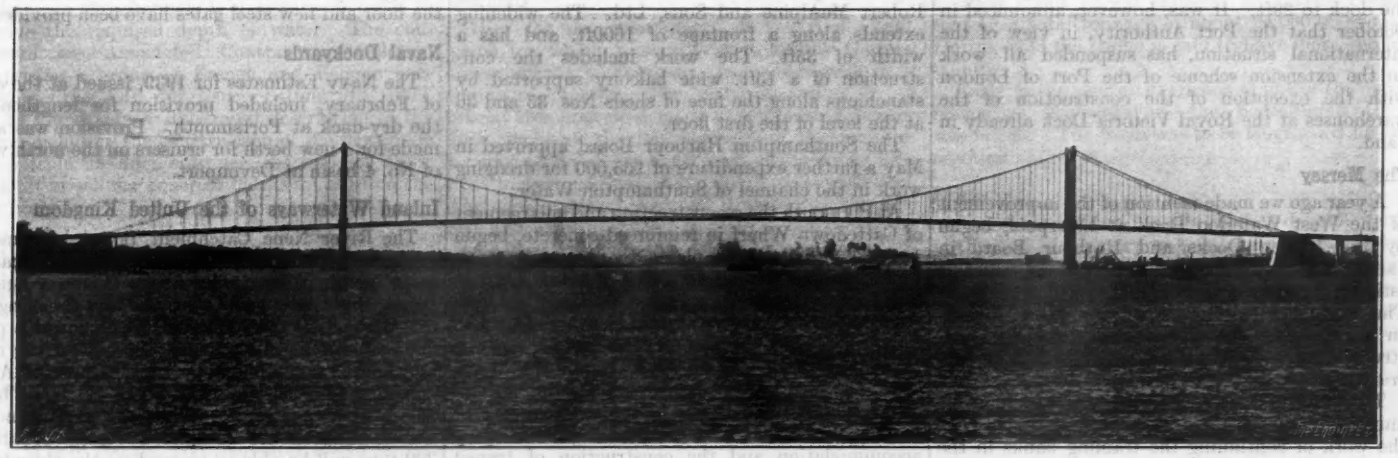
On May 24th there was declared open the Otto Beit bridge over the Zambesi river. This structure links Northern and Southern Rhodesia and spans the Chirundu gorge. It is a suspension bridge with a main span of 1050ft., carrying an 18ft. roadway and two 3ft. footways, and its towers are 150ft. high. There are four 40ft. approach spans at the southern end. The bridge was designed by Mr. Ralph Freeman of Freeman, Fox and Partners of Westminster, and the contract for its construction, valued at over £120,000, was placed by the Beit Railway Trust with Dorman, Long and Co., Ltd., in May, 1937. That firm also fabricated the steelwork.

America

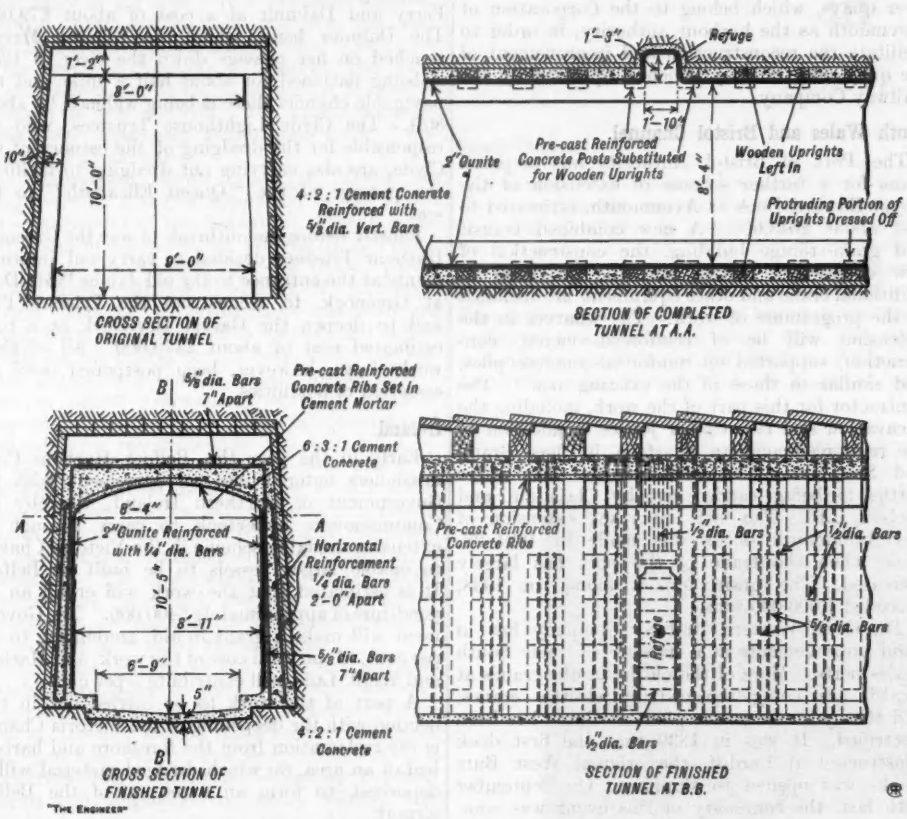
There always seem to be great bridges under construction on the other side of the Atlantic. A notable one opened in April of last year is the Bronx-Whitestone bridge across the East River, New York, which we described recently. Like so many others built in America in recent years, it is a suspension structure and it has a central span of 2300ft., side spans of 735ft., and approach viaducts 1861·33ft. and 1046·83ft. long respectively. At mid-span the under-clearance at mean high water is 148ft. With its two approach highways, the bridge has cost 17,785,000 dols., and it was built for the Triborough Bridge Authority, out of funds raised by the sale of serial bonds which will be redeemed by the levying of tolls on vehicles using the bridge. It has been estimated that as many as 6,500,000 vehicles will use the bridge in its first year of service. An accompanying engraving illustrates the structure.

Another bridge of some interest now under construction in America was described in our issue

BRONX-WHITESTONE BRIDGE OVER THE EAST RIVER, NEW YORK



of August 11th. It is a concrete pontoon bridge 6620ft. long, and it crosses an arm of Lake Washington to carry a new highway running eastward from the City of Seattle in the State of Washington. It has a telescopic draw span that provides a channel 202ft. wide. The bridge is far from being merely a flexible "bridge of boats." It consists of a series of twenty-two rectangular pontoons ranging in length from 218ft. to 350ft., and its draw span has a length of 378ft. Instead of floating independently, most of the pontoons are connected end to end by heavy bolts and shear locks with grouted joints so as to form a rigid box-like structure 59ft. wide and 14ft. 6in. deep, in typical section, with a freeboard of 7ft. when floating without load. The upper surface forms a roadway 45ft. wide with a 4ft. pathway on each side.



SECTIONAL VIEW OF THE CHURIA TUNNEL, NEPAL

Harbours and Waterways in 1939

No. I

A YEAR ago we referred to the effect of the disturbed condition of international relations in stimulating activity among the great Naval Powers in making increased provision for fleet accommodation in ports. This effect had, we said, been noticeable not only in Great Britain, but also in the United States and Japan. So far as Great Britain is concerned, little can be said in the Press at present on the subject of the works that are being carried out in British ports at home and abroad for the accommodation of the Naval forces of the Crown, or in the way of emergency accommodation in home ports necessitated by the partial diversion of sea-borne traffic from its normal routes.

There is little to be known of what is being done in Germany at the present time; but at the outbreak of the war it was known that a further enlargement of the Kiel Canal was in progress, and that there was considerable activity in some of the Baltic and North Sea ports of Germany having as its object the increase of accommodation for various classes of shipping. Moreover, the enlargement of the Rhine–Main–Danube navigation was being pressed on with the utmost vigour. When, however, war came in September, this vast project was still some years distant from its completion, and throughout the central section river barges of small capacity only are able to navigate.

A statutory measure which is of considerable interest to engineers concerned with works on the sea-coast received the Royal Assent on July 13th, 1939. It is the Coast Protection Act, which extends the powers of the Board of Trade in connection with the making of Orders prohibiting removal of material from the foreshore. Formerly these powers were restricted in several directions and, in general, to removal from the legal foreshore below mean high-water. The new Act extends the powers of the Board to cover the issue of Orders relating to all parts of the "sea-shore," which is defined as including cliffs, banks of the sea, dunes, beach, and other land adjacent to the foreshore and sea-bed.

BRITAIN AND IRELAND

The Port of London

The 31st March last was the thirtieth anniversary of the day on which the Port of London Authority came into being. The present Chairman of the Authority, Lord Ritchie of Dundee, is one of the two original members still serving on the Board. In thirty years the tonnage of shipping that annually uses the Port of London has increased by approximately 66 per cent. and, since the beginning of the Port Authority's control, the Board have expended on new works completed upwards of £20,000,000. During the present year much of the attention of the Board's officials has been directed to the provision of air-raid precautions. It is reported that a sum approaching £400,000 has been expended in this connection.

The entry into the Port of London, on August 6th, 1939, of the new Cunard-White Star liner "Mauritania" was an important event in the history of the river. On that day the "Mauritania," of 35,739 gross tons, docked in the King George V Dock, the entrance lock being just large enough to take her in. The largest vessel hitherto using the Port of London had been the "Georgic" of 27,759 tons.

The remodelling of the north side of the Royal Victoria Dock, where the pre-existing accommodation comprised five jetties completed about eighty years ago, work on which was begun in January, 1937, by the contractors, J. Mowlem and Co., Ltd., is still in progress. The new works comprise a continuous open-type reinforced-concrete quay, 3255ft. long with five three-storey sheds each of which measures 500ft. by 150ft. The principal work now remaining to be done is the completion of these sheds. The widening of the east quay of the Millwall Dock, 1310ft. long, and the construction of two-storey warehouses in connection with it were completed during the Spring of 1939. Here again the quay work has been carried out by John Mowlem and Co., Ltd., who are also responsible for the recently completed extension of quay accommodation in the West India Dock.

At the Surrey Commercial Dock the reconstruction of a quay in the South Dock and the building of two large warehouses, together with the provision of new crane equipment, were also completed in the course of the year.

In January, the Authority sanctioned the reconstruction of the north quay in the Millwall Outer Dock with the object of providing increased accommodation for Swedish trade. Two two-storey quay sheds, each 423ft. long and 100ft. wide, are to be built in connection with the quay reconstruction, and the remodelling of the existing

road and railway lines is to be undertaken. The cost of this section of work is estimated to be about £200,000 which includes the deepening of the dock to 29ft. It was, however, announced in October that the Port Authority, in view of the international situation, has suspended all work on the extension scheme of the Port of London with the exception of the construction of the warehouses at the Royal Victoria Dock already in hand.

The Mersey

A year ago we made mention of the improvement of the West Waterloo Dock at Liverpool, begun by the Mersey Docks and Harbour Board in January, 1937. This work, the cost of which is estimated to be about £732,000, is still in progress. The work is being carried out by direct labour. In June, 1939, the Board sanctioned the construction of a double-storey shed with four roof cranes at the West Waterloo Dock.

The Chairman of the Board, in the course of his annual statement made recently, mentioned that the work of continuing the training banks in the sea-channels, which had shown every sign of producing the anticipated result, had been discontinued since the outbreak of war.

North-East Coast and Humber Ports

The project of the Tyne Improvement Commission for the improvement and development of their Tyne Dock property has been severely curtailed as a result of the war. It will be remembered that the Commissioners took over Tyne Dock from the London and North-Eastern Railway Company in May, 1937. The scheme for the improvement of the dock and the construction of new river quays in the vicinity of the dock is estimated to cost about £1,000,000. In December, 1938, the Commissioners invited tenders for the construction of a new quay in the dock near its north-west corner. The building of this quay, 800ft. long, at a cost of about £250,000, was begun by the contractors, Brims and Co., Ltd., early in the year, and is still being proceeded with; but work on the larger riverside quay, 1400ft. long, which will have a depth alongside of 35ft. at low-water of spring tides, plans for which were completed early in the Summer, will be postponed. This work was estimated to cost about £750,000. The new traffic offices and locomotive sheds which the Commissioners had been building at Tyne Dock are now completed and were opened in February, 1939.

The Tyne Commissioners have also completed, during the year, the construction of a timber quay 925ft. long at Hebburn.

It is announced that Joseph Rank, Ltd., is to build a flour mill and silos, with a riverside quay, at a cost of approximately £500,000.

A new coal staith has been constructed at Seaham Harbour. At Sunderland, the River Wear Commissioners have proceeded with the improvement of the harbour entrance channel by deepening and straightening; a considerable amount of rock excavation is involved in this work. The Commissioners also completed, in July, the construction of a new fish-quay and fish-market at a cost of over £45,000: the bulk of the work is in reinforced concrete. The building of a new dry-dock at Sunderland was to have been begun at the end of 1939 by T. W. Greenwell and Co., Ltd., the owners of a large ship-repairing and dry-docking establishment, on the site of the old No. 1 graving dock which has been leased to the company by the River Wear Commissioners. This work has, however, now been postponed owing to war conditions.

The London and North-Eastern Railway Company has modified their plans for extending the fish docks at Hull, work on which was begun at the end of 1936. This modification involved some curtailment of the scheme consequent on the depression which has come upon the fishing industry. Early in the year, the Railway Company placed a contract with A. Jackaman and Son, Ltd., which includes the widening of the waterway between St. Andrew's Dock at Hull and the dock extension.

The Tees Conservancy Commissioners are proceeding steadily but slowly with the Seal Sand reclamation project. The work is being done by direct labour, and no date has yet been fixed for its completion. The gaining of about 300 acres from the estuary of the Tees is one of the objects of the works.

Southern Ports

The widening of the Itchen quays at Southampton, comprising the berths known as Nos. 34, 35, and 36, south of the entrance to the Empress Dock, mentioned in our review a year ago was begun early in 1939. The contractors are Sir Robert McAlpine and Sons, Ltd. The widening extends along a frontage of 1600ft. and has a width of 35ft. The work includes the construction of a 15ft. wide balcony supported by stanchions along the face of sheds Nos. 35 and 36 at the level of the first floor.

The Southampton Harbour Board approved in May a further expenditure of £65,000 for dredging work in the channel of Southampton Water.

At Plymouth the reconstruction and enlargement of Cattedown Wharf in reinforced-concrete, begun in 1936, has been completed by the contractors, Christiani and Nielsen, at a cost of about £37,000. Sir Lindsay Parkinson and Co., Ltd., are still engaged, as contractors, on the building of a small breakwater and harbour at Maseline Bay in the Island of Sark. Work was begun in June, 1938, the engineers being Messrs. Coode, Wilson, Mitchell, and Vaughan-Lee, and the cost is estimated at £45,600. An extension of the quay accommodation and the construction of transit sheds and other works have been completed at Falmouth for Coast Lines, Ltd., at a cost of £50,000.

The Great Western Railway Company is carrying out at Weymouth the reconstruction and re-alignment of a considerable length of the river quays, which belong to the Corporation of Weymouth as the harbour authority, in order to facilitate the reconstruction and improvement of the quay-side tramway which is operated by the Railway Company.

South Wales and Bristol Channel

The Port of Bristol Authority has prepared plans for a further scheme of extension of the Royal Edward Dock at Avonmouth, estimated to cost about £643,000. A new combined transit and grain-storage building, the construction of new deep-water berths, and the provision of additional crane and other equipment are included in the programme of work. The wharves in the extension will be of reinforced-concrete construction, supported on reinforced-concrete piles, and similar to those in the existing arm.* The contractor for this part of the work, including the excavation and two timber jetties in addition to the reinforced-concrete wharfage, is Chas. Brand and Son, Ltd. The work on the deep-water berths is being carried out by Christiani and Nielsen, Ltd. The last important extension of the Avonmouth docks was made in 1924–28, since when the trade of the port has largely increased. The grain import alone, in 1938, exceeded 1,000,000 tons.

The Great Western Railway Company has in hand improvements at a number of their South Wales ports. More of the old hydraulic cranes at Cardiff are being replaced by electric cranes, and the hydraulic power plant at Barry has been electrified. It was in 1839 that the first dock constructed at Cardiff—the original West Bute Dock—was opened to shipping. On September 20th last, the centenary of this event was commemorated by the unveiling by the Lord Mayor of Cardiff of a plaque on one of the walls of the Great Western Railway Company dock office near the West Dock Basin at Cardiff. The original West Bute Dock had a water area of 20 acres; to-day the enclosed water-area of the Cardiff dock system is 160 acres.

New steel lock gates have been constructed for the inner end of the South Lock at Newport. The old gates will be overhauled and kept in reserve as spares for use in case of emergency.

North-West Coast

The London, Midland and Scottish Railway have constructed at Fleetwood a reinforced-concrete slipway for drifters and trawlers, and are reconstructing a portion of the river quay. The expenditure involved is about £124,000. At Barrow, the company is building a new quay in a Buccleuch Dock and the entrance gates of the Ramsden Dock are being renewed.

The Maryport Harbour Commissioners have begun the reconditioning of the harbour works at an estimated cost of £100,000, the expenditure being met in part by loan and in part out of a free grant made by the Commissioner for Special Areas.

The work of reconditioning and remodelling Whitehaven Harbour, for which financial assistance has also been forthcoming from the Special Areas fund, was completed in the Summer at a cost of over £30,000. These works were begun in July, 1938: the entrance to Queen's Dock has been enlarged by the removal of the curved invert to the floor and new steel gates have been provided.

* *Vide* THE ENGINEER, May 15th and 25th, 1928.

Naval Dockyards

The Navy Estimates for 1939, issued at the end of February, included provision for lengthening the dry-dock at Portsmouth. Provision was also made for a new berth for cruisers on the north wall of No. 4 basin at Devonport.

Inland Waterways of the United Kingdom

The River Nene Catchment Board has practically completed the piling along the river banks for a length of two miles above Wisbech Bridge begun about two years ago, and the dredging of this part of the river channel, which forms a part of the improvement scheme, one-half of the cost of which is contributed by the Ministry of Agriculture and Fisheries, was about to have been begun when war came. When the improvements above Wisbech are completed vessels of about 300 tons will be able to proceed up the river from Wisbech as far as Peterborough.

Scotland

The Clyde Navigation Trustees have continued during the year the deepening and widening of the navigable channel of the river between Erskine Ferry and Dalmuir at a cost of about £79,000. The Dalmuir bend, where the "Queen Mary" touched on her passage down the river in 1936, is being flattened for about half a mile, and the navigable channel there is being widened by about 80ft. The Clyde Lighthouse Trustees, who are responsible for the dredging of the estuary of the Clyde, are also carrying out dredging to facilitate the passage of the "Queen Elizabeth" to the sea.

Shortly before the outbreak of war the Greenock Harbour Trustees decided to carry out improvements at the entrance to the old James Watt Dock at Greenock, to reconstruct the Prince's Pier, and to deepen the Garvel Dry-Dock at a total estimated cost of about £140,000. All of these works have, however, been postponed until the cessation of hostilities.

Ireland

Early in the year the Belfast Harbour Commissioners entered into an agreement with the Government of Northern Ireland, whereby the Commissioners undertook to carry through an extensive dredging scheme in the Victoria Channel to enable larger vessels to be built at Belfast. It is estimated that the work will entail an expenditure of approximately £400,000. The Government will make a grant in aid, amounting to 55½ per cent. of the total cost of the work, and Harland and Wolff, Ltd., will contribute 5 per cent.

A part of the work to be carried out in connection with the deepening of the Victoria Channel is the reclamation from the foreshore and harbour bed of an area, on which dredged material will be deposited, to form an extension of the Belfast airport.

The Harbour Commissioners of Londonderry have completed the deepening of the approach channel to that port through Lough Foyle. The Government of Northern Ireland have contributed one-half of the cost of this work, the expenditure on which has been about £50,000.

The London, Midland and Scottish Railway has recently brought into use at Larne in Northern Ireland an electrically operated car-ramp for use in connection with the new service for the transport of motor-vehicles between Stranraer and Larne. The new passenger vessel, "Princess Victoria," has been specially constructed to accommodate about eighty cars, which are run on board through an opening at the stern of the vessel similar to that usually provided in train-ferries. We published an illustrated account of this work in our issue of November 24th, 1939. A similar ship-berth and car-ramp has been constructed by the Railway Company at Stranraer, the Scottish port used by this cross channel service.

The Dublin Port and Docks Board has deposited a private Bill in the Dail by which powers are sought to carry out a number of improvements in the port, and to raise £870,000 for that purpose.

A year ago we made brief mention of the works being carried out at Galway Harbour in connection with the enlargement and improvement of the port. These works, which were begun in October, 1937, are now not expected to be completed for some time. The total cost is estimated at £210,000, and the work includes a new dock

entrance 65ft. wide, and the deepening of the entrance channel and the approaches to the dock. A considerable quantity of rock-breaking and dredging in the channels is necessary in order to provide the required depth of water. The contractors are Associated Contractors (Ireland), comprising a group of French and Belgian contracting firms. In our issue of June 9th, 1939, will be found a fully illustrated description of the works, including the construction of the new guide pier outside the dock entrance, the walls of which are built of cellular concrete blocks founded on the rock bottom.

EUROPEAN PORTS AND WATERWAYS

France

It was announced early in the year that the French Minister of Marine had sanctioned the building of a construction-dock 300 m. long at Laninon in the Naval dockyard of Brest. Hitherto the large warships built at Brest have been partially constructed in the Salou dry-dock, the length of which is only 200 m., and thereafter towed to the existing Laninon dock to be completed. This makeshift was resorted to during the construction of the "Richelieu" and "Dunkerque."

The new optical apparatus for the lighthouse at Creach d'Ouessant which was shown at the Paris Exhibition in 1937 was put in service at the lighthouse early in the year. It is probably the most powerful lighthouse optic at present in use, and, when the electric power-station now being built on the island of Ouessant is in service, the maximum candle-power of the light will, it is said, be increased to 500 millions. The apparatus comprises two separately illuminated optics, one superposed on the other.

A Government decree issued in March has brought about a radical alteration in the status and management of two important French ports. Until about fifteen years ago, practically all French ports were administered by the State, partly through local Maritime Chambers of Commerce. In 1924, however, self-government was conferred on the Ports of Havre and Bordeaux, and subsequently on the inland port of Strasbourg, the role of the State being limited mainly in the case of these, so called, autonomous ports to financial supervision. In November, 1938, a committee of administrative reorganisation was appointed by the Government to further the new policy of economic reform. This committee recommended the suppression of fifteen self-governing administrations including the ports of Havre and Bordeaux. The autonomous administration of Strasbourg is maintained. The Association des Grands Ports Français has protested strongly against the Government decree, and the Maritime Chambers of Commerce have taken the same line.

The formal opening of the new *gare maritime* at Calais took place on June 17th, the ceremony being performed by the Minister for Public Works. Work on the new station has been proceeding for close upon nine years. The new Customs hall is about 165ft. long; the quayside platform has been widened and lengthened to nearly 1600ft., and five level crossings have been done away with.

The reconstruction of the Bassin de la Joliette at Marseilles, which has been in progress since 1932, has now been completed and all of the four new oblique jetties, each about 280 m. long, which project from the old east quay wall of the *bassin* are in use. The remodelling of the *bassin* has provided sixteen berths for ocean liners, 500 m. of quayage for coasting vessels and inland craft, and over 110,000 square metres of sheds and other covered spaces. The new sheds on the jetties of the Bassin de la Joliette, all of which are now completed, are fine structures of reinforced-concrete of two and three storeys.

The construction of the main enclosing walls of the Bassin Mirabeau at the northern end of the range of *bassins* at Marseilles was planned to be completed in 1940; but it is probable that war conditions will prevent the realisation of this programme. The Mirabeau group of works, begun in 1936, includes an extension northward of the great outer mole for a length of 1325 m. which has already been completed.

At the southern end of the harbour one of the breakwaters which will protect the future Bassin du Pharo is under construction. It is an island mole 444 m. long known as the Digue des Catalans, begun in 1937. It is of the classic Marseilles mound type and affords protection to the *avant-port* Joliette.

The new *gare maritime* on the Cap Janet pier, which lies between the Bassin President Wilson and the Bassin Mirabeau, is now nearing completion.

Germany

How far the enlargement of the Kiel Canal, plans for which were approved by the German Government in February, has progressed it is impossible to say. The plans, according to an official announcement made in Berlin on February 15th, included the improvement of the facilities for navigation in the lower part of the River Elbe near to the entrance of the canal at Brunsbüttel. The canal entrance locks at Holtenau at the Kiel end and at Brunsbüttel were to be enlarged, the canal itself widened and deepened, and the headroom under the bridges which cross over the canal at several points was to be increased so as to permit of the passage of vessels with higher masts. The previous depth of the canal was 37ft. and it was available to ships with a beam not exceeding 131ft. and a draft of 29·7ft. While there is little doubt that the decision further to enlarge the canal was dictated by military requirements, it was officially stated that the enlargement was necessary on account of the increase of general traffic through the canal which for the year 1937 totalled about 53,400 ships of all classes representing a total tonnage of about 24,000,000 tons. During 1938 the traffic is said to have increased in volume.

Early in the year an extension of one of the open basins at Bremerhaven—the Kaiserhafen II—was begun. The basin was to be lengthened by an addition of 700 m.

Belgium

A pre-war scheme for the further development of the port of Antwerp was under consideration by the Government early in the year. Its realisation, unfortunately, must lie in the unknown future. The project includes the construction of a second large entrance lock to the docks at Kruisschans, the removal of the oil-storage depot to a more suitable area, and quay extensions on the right bank of the river Scheldt.

(To be continued)

River Control and Water Storage in 1939

No. II

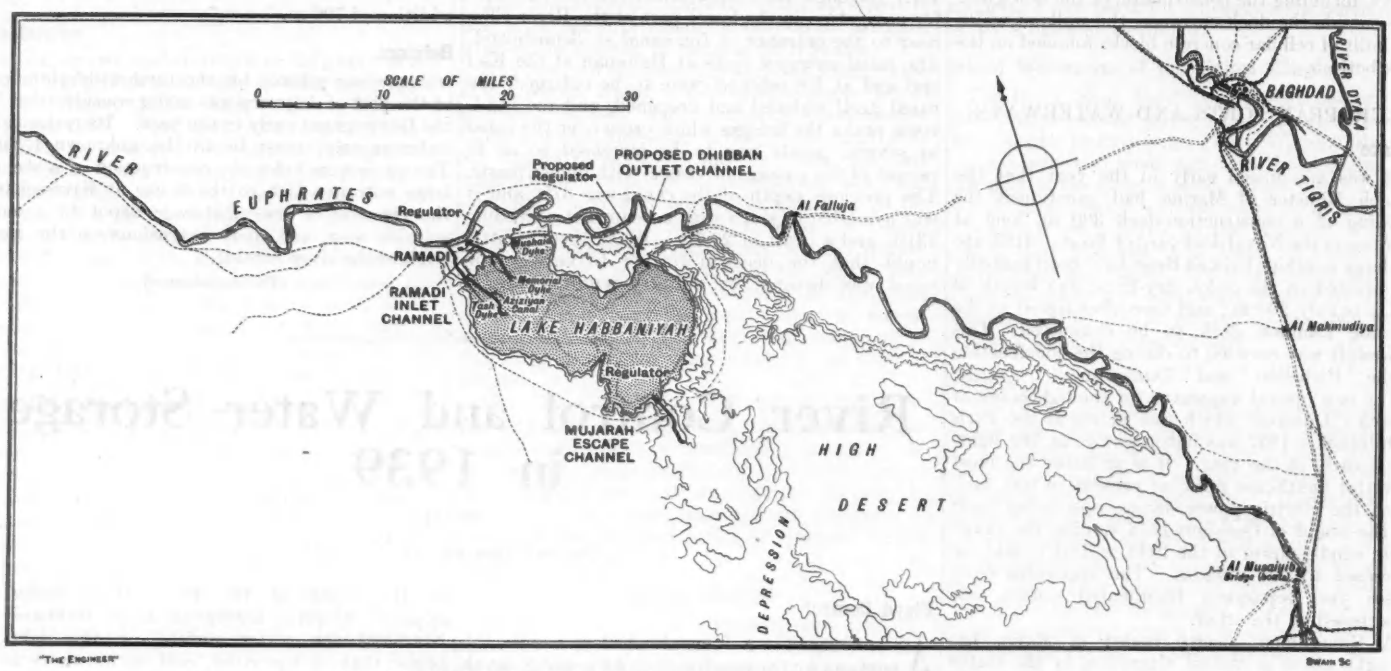
(Continued from page 12, Jan. 5th)

Flood Control

AS announced in a Journal note last month, the contract for the construction of the Habbaniyah flood control scheme in Iraq, awarded to Balfour, Beatty and Co., Ltd., was signed on behalf of that country by M. Jala Baban, Iraq Minister of Communications and Works, on December 4th, The works now about to be begun to mitigate floods on the Euphrates were first suggested as far back as 1911 by Sir William Willcocks. About 30 miles to the west of Baghdad, and to the south of the river, there exists an expanse of water known as Lake Habbaniyah. Normally the water surface of the lake is below that of the river, and under the scheme which is now to be carried out under the direction of Messrs. Coode, Wilson, Mitchell, and Vaughan-Lee, of Westminster, a channel, to be known as the Ramadi inlet channel, 7½ kiloms. long, 92 m. wide, and 4¼ m. deep, will be excavated from the river into the north-eastern end of the lake. The situation of this channel is shown on the plan reproduced from an illustrated article published

SITE OF GENISSIAT DAM—JULY, 1939

in our pages on June 30th last. About half way along the inlet channel, there will be a regulator structure with 12 gates each 6 m. wide. Since some of the banks of the lake are low, some low and comparatively short stone-faced earthern banks will be built to prevent water diverted into the lake escaping back into the river. The capacity of the lake not being great enough to absorb all the water which will be diverted into it, an escape channel about 8 kiloms. long will be excavated from the opposite side of the lake. It will carry the water to a barren depression in the desert, south of the lake where it will disappear as a result of evaporation and adsorption. The outlet channel will have a regulator with eight openings 6 m. wide. The complete scheme, as envisaged by Sir William Willcocks, provides for an outlet channel on the north-eastern side which, when the floods had passed, would permit water from the lake to be discharged back into the river. This channel is shown on the plan, but is not included in the present contract.



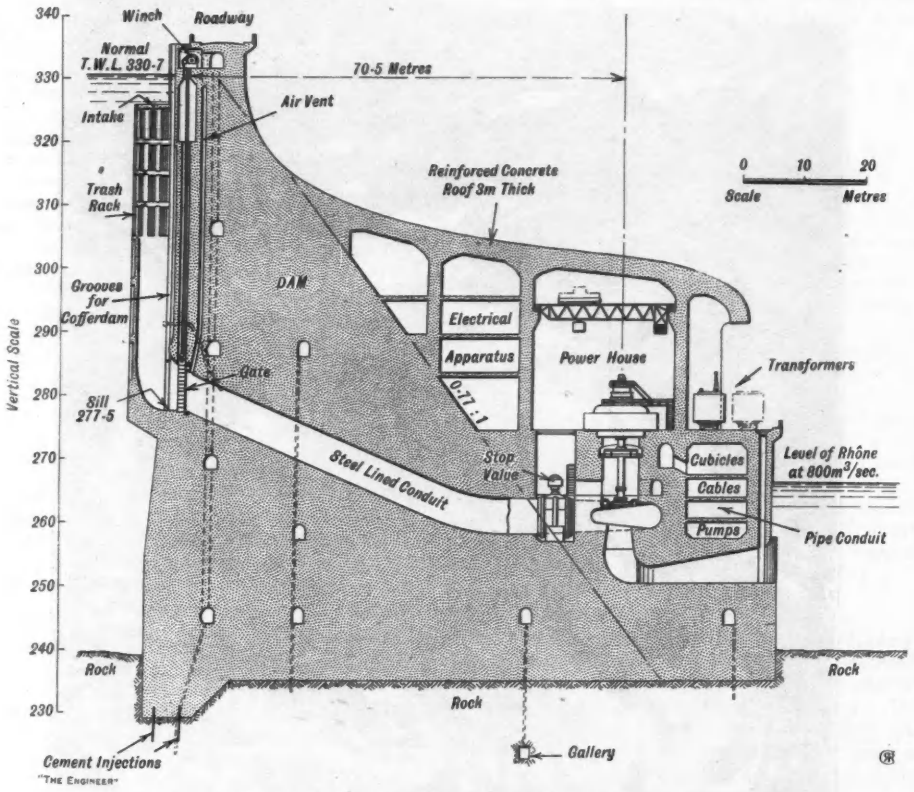
MAP OF LAKE HABBANIYAH SHOWING SITUATION OF FLOOD CONTROL WORKS

Hydro-Electric Power

We intend to mention only one scheme of this character. It is that of constructing a dam on the Rhône in France at Genissiat, across a deep and narrow gorge and developing eventually 420,000 kW from the resulting fall of water. This scheme was originally described in our pages on December 30th, 1938, and a further illustrated article dealing with it appeared in our issue of November 24th, 1939.

During the year under review, the original plans for the Genissiat scheme were modified. As originally designed, the power units were to be placed in power houses arranged on each side of the gorge below the dam in a manner similar to that adopted at the Boulder dam in America, with which indeed the Genissiat scheme has many points of resemblance, although on a much smaller scale. It has now been decided, that there shall be six power units spaced 21 m. apart, in a power house aligned along the downstream face of the dam, as indicated in the section reproduced, each turbine being fed by an independent penstock 5·75 m. diameter in the body of the dam. The roof of the power house will consist of a heavily reinforced concrete slab 3 m. thick, as a protection against aerial bombardment. Turbines are to be installed in two stages, the first consisting of four 65,000 kW units, and the second of two units of 65,000 kW, or alternatively 80,000 kW capacity. Alterations are also to be made to the flood discharge works. There is to be an open flood spillway, and a channel on the right bank with a movable gate 41 m. long by 6 m. deep, four discharge culverts on the left bank to discharge into the left bank diversion tunnel, each with duplicate control gates 3m. wide by 8 m. high, and also low level discharge culverts into the right bank diversion tunnel.

With regard to the progress of the work, the excavation of the right bank diversion channel was completed in December, 1938, and that of the left bank tunnel in February, 1939. The amount of rock removed was 215,500 cubic metres. The water was admitted to them in April and May respectively. Owing to the fact that there was delay in the delivery of the large stop gates for the upstream portals temporary cofferdams consisting of horizontal concrete arches 0·40 m. thick were built of pre-cast concrete blocks across excavated channels near the portals. When the time came, these cofferdams were destroyed by explosives. The main cofferdams upstream and downstream of the site of the dam and within the protection of which work is being carried on, were raised during the year to their intended heights. Protection is now given to the site against floods up to 1400 cubic metres per second. As a flood as great as 2000 cubic metres per second might be experienced—they occur about once in 50 years—the rock debris from the excavation for the dam foundations is being tipped on the upstream cofferdam to raise its crest height. Excavation is being carried out by the use of scrapers, conveyors, and overhead cableways. A photograph reproduced shows the conditions existing in July as seen from the downstream overhead cableway and looking towards the upstream cofferdam which is visible in the distance.



SECTION THROUGH GENISSIAT DAM AND POWER STATION

CORBY COKE OVEN PLANT.—In connection with the article on "Electrical Equipment of Coke Oven Plant" in our issue of December 29th, we are informed that the Wellman Smith Owen Engineering Corporation, Ltd., Victoria Station House, London, S.W.1. supplied two combined coke pushing, coal levelling and door extractor machines, two door extractor machines with coke guides, two coal charging cars, and two coke quenching cars.

THE MINES DEPARTMENT.—Under Section 5 of the Coal Mines Act, 1930, as amended by the Coal Act, 1938, Committees of Investigation and a Central Appeal Tribunal were set up to investigate complaints by consumers with respect to the operations of the Coal Marketing Schemes constituted under Part I of the Act and administered by the Central and District Boards of coal-owners. As the coal mining industry is now acting under the directions of the Government in regard to the supply and sale of coal, the Committees of Investigation and the Central Appeal Tribunal are inappropriate in present circumstances. An Order has, therefore, been made under the Emergency Powers (Defence) Act, to suspend the activities of these bodies, but in order to ensure that the claims of consumers may be properly represented, it has been arranged with the Central Price Regulation Committee set up under the Prices of Goods Act, to act during the war as an Advisory Committee to the Secretary for Mines on any matters he may refer to them affecting the interests of consumers of coal. The Committee will undertake this work in a non-statutory capacity since control of coal prices is not being exercised under the Prices of Goods Act.

Naval Construction in 1939

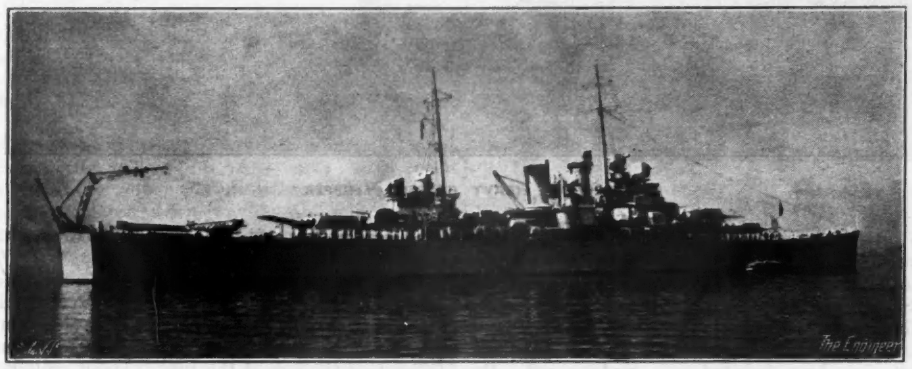
By FRANCIS McMURTRIE, A.I.N.A. (*Editor of "Jane's Fighting Ships"*)

No. II

(*Continued from page 3, Jan. 5th*)

United States

AT the present date the total of warships and fleet auxiliaries under construction and authorised for the United States Navy is little short of 550,000 tons. In this figure are included two battleships of 45,000 tons, the "Iowa" and "New Jersey," which have been ordered under the 1939 programme, but are not expected to be laid down before July next; six battleships of 35,000 tons, "North Carolina," "Washington," "Indiana," "Massachusetts," "Alabama," and "South Dakota," of which three have so far been laid down; the aircraft carriers "Hornet," of 19,900 tons, and "Wasp," 14,700 tons; the cruisers "Atlanta," "Juneau," "San Diego," "San Juan," of 6000 tons, together with the "Cleveland" and "Columbia," the displacement of which has still to be settled; 30 destroyers, of which six are of 1570 tons, and the remainder of 1630 tons; 18 submarines, displacing from 1450 to 1475 tons; the minelayer "Terror" of 6000 tons; a dozen depot ships, or tenders, to use the American term; and a similar number of motor torpedo boats and submarine chasers.



AMERICAN HEAVY CRUISER "WICHITA"

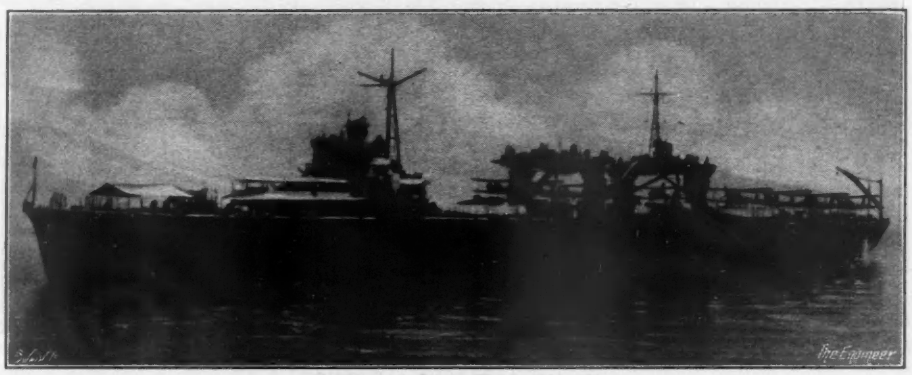
Contracts for the eight capital ships have been allotted as follows:—

"Iowa"	New York Navy Yard.
"New Jersey"	Philadelphia Navy Yard.
"South Dakota"	New York Shipbuilding Corporation.
"Alabama"	Norfolk Navy Yard.
"Massachusetts"	Bethlehem Shipbuilding Corporation, Quincy.
"Indiana"	Newport News Shipbuilding Company.
"Washington"	Philadelphia Navy Yard.
"North Carolina"	New York Navy Yard.

Delays in laying down these ships have been due to changes in design, late delivery of material, and the necessity for extending and strengthening building slips. It is known that the ships are to be of welded construction to the extent of at least 35 per cent., and that the engine rooms will be arranged on a novel plan in order to save weight. It is proposed to give both the 35,000-ton and 45,000-ton ships the same main and secondary armaments, viz., nine 16-in. and twelve 5-in. (51 calibre) guns. In the case of the first six ships, a speed of 28 knots is provided for, but the "Iowa" and "New Jersey" are to be very much faster, the extra displacement being largely absorbed by increased engine and boiler power. A speed of 33 knots has been reported unofficially.

The aircraft carrier "Hornet" was laid down recently by the Newport News Company. She is understood to be more or less a replica of the "Enterprise" and "Yorktown," completed by the same shipbuilders in 1938. Though these ships have already been described fully in these columns, it may be stated again that they displace 19,900 tons, with a speed of 34 knots, and a main armament of eight 5-in. (38 calibre) guns.

The aircraft carrier "Wasp," which was launched from the Quincy Yard of the Bethlehem Shipbuilding Corporation in April last, appears to be an improved "Ranger." Her length over all is slightly less, 739ft. instead of 769ft., but she draws a trifle more water. The displacement is 14,700 tons, as against 14,500 in the "Ranger." There are eight 5-in. guns as in the "Ranger," but they are of more recent pattern, 38 calibres long instead of 25.



JAPANESE SEAPLANE CARRIER "MIDUHO"

The principal ship commissioned by the United States Navy last year was the heavy cruiser "Wichita," of 10,000 tons. Originally she was to have been the eighth unit of the "Minneapolis" class, but as completed she embodies certain features of the "Brooklyn" type. Though her armament remains the same as in the "Minneapolis," nine 8-in. and eight 5-in. guns, the aircraft are carried below the quarter deck, instead of in a prominent hangar around the foot of the mainmast. As will be seen from the illustration, on this page, she bears more outward resemblance to the "Brooklyn" than to the "Minneapolis."

The light cruisers "Atlanta," "Juneau," "San Diego" and "San Juan" were all ordered in April, 1939, the first pair from the Federal Shipbuilding and Dry Dock Company, Kearny, and the second pair from the Bethlehem Shipbuilding Corporation, Quincy. On a displacement of 6000 tons they are expected to mount a main armament of nine 6-in. guns, though there have been rumours of an alternative design in this respect. The contract speed is stated to be 38 knots, as these ships are intended to act as flagships of destroyer squadrons.

Little is known about the cruisers "Cleveland" and "Columbia," authorised for construction under the 1939 programme, one of which will probably be built in a Navy Yard and one by contract. Under the London Naval Treaty of 1936 their displacement would have been restricted to 8000 tons, but now that its provisions have ceased to have any effect it is quite likely that these two ships will be improved "Wichitas" or "Brooklyns."

In design the destroyers now building are of the standard type of which so many examples have already been completed for the United States Navy, with a single funnel and a main armament of five 5-in. guns, though in the last 24 it is possible that an additional gun may be mounted. It has been officially admitted by the Secretary of the Navy that overloading has affected the stability of certain recently completed destroyers, but it is maintained that "fully adequate" measures to correct these defects have been taken.

JAPANESE AIRCRAFT CARRIER "SORYU"

Of the various fleet auxiliaries in hand, the most interesting promises to be the submarine tender "Fulton," of 9250 tons, which is to have Diesel engines of novel design. It is understood that the contract specifies 12,000 B.H.P. for a speed of 20 knots. Submarines under construction include the balance of the "Sargo" class, of which one, the "Squalus," was recently salved after foundering on May 23rd, 1939; six of the "Thresher" class; and six of the "Grampus" class. It is believed that the latter types will differ from the "Sargo" in silhouette, hull form, and internal lay-out. Three of the "Thresher" class are to have General Motors (modified Winton) Diesels, and three Fairbanks-Morse Diesels. In addition to the foregoing, two 800-ton submarines with "Nelseco" Diesels have been ordered under the 1939 Programme.

About ten motor torpedo boats are believed to be on order from various yards. Four of these will be 59ft. in length, and two 81ft. It is reported that the remaining M.T.B. are to be of British design, built in the United States under licence. Three submarine chasers are also in hand, two of them being wooden craft 110ft. in length, and the third a steel vessel of 170ft.

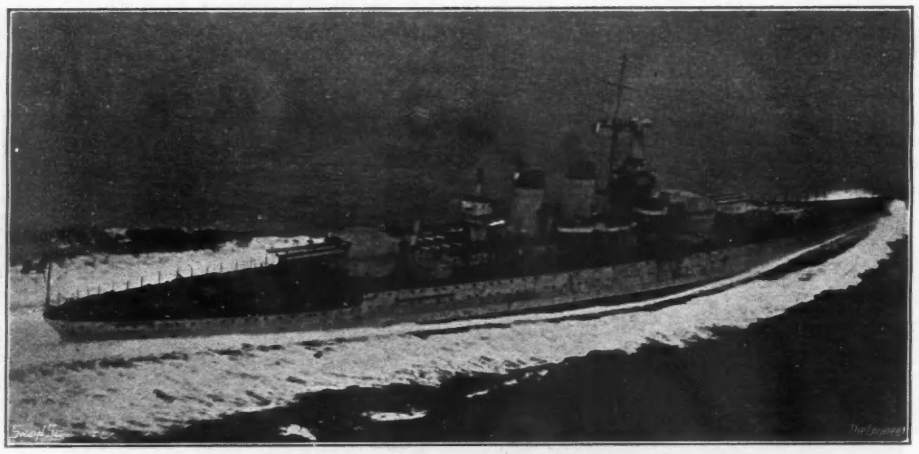
Japan

Though official information is practically non-existent, there is reason to believe that four

battleships of over 40,000 tons are under construction. One of these, the "Nisshin," was launched from the Naval Dockyard at Kure on November 30th, and an otherwise unidentified warship which went afloat at Kobe on November 27th, the "Zuikaku," may prove to be a sister. It is possible that the "Kadekuru," launched at Yokosuka on June 1st, is yet another of the same type, though there are unconfirmed reports that she is a battle cruiser of 16,000 tons. The aircraft carriers "Soryu" and "Hiryu," of 10,050 tons, are both in service. A photograph of the "Soryu" is reproduced herewith. It is understood that the "Hiryu" differs from her in having a light tripod mast abaft the bridge on the starboard side. Each of these ships is armed with twelve 5-in. high-angle guns, mounted in pairs. A third vessel which may belong to this class is the "Syokaku," launched at Yokosaka on June 2nd. But in view of a report that her length is over 800ft. as compared with the 688ft. of the "Soryu," it is possible that she is of a new and much larger design. Both the "Kaga" and "Akagi," earlier aircraft carriers of 26,900 tons, have been completely refitted, their flight decks being extended over the bows and an island superstructure added on the starboard side.

The last two cruisers of the "Mogami" class, the "Tone" and "Tikuma," have been completed, mounting twelve 6·1-in. guns instead of fifteen as in the earlier ships of the class. It was recently reported that their quarterdecks have been taken up with aircraft launching arrangements, but until the receipt of a photograph this cannot be confirmed.

Quite the queerest looking ships that even Japan has produced for some time past are the three 9000-ton seaplane carriers "Titose," "Tiyoda," and "Miduho," as will be seen from the accompanying illustration of the last-named ship. She has a speed of only 17 knots as compared with



ITALIAN BATTLESHIP "LITTORIO"

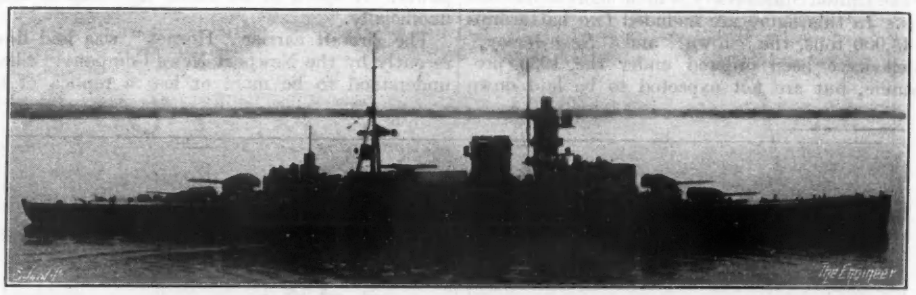
20 knots in the case of the other two, but as some compensation mounts six 5-in. high-angle guns instead of four. During the past sixteen months Japan has launched eleven big new destroyers with a displacement of 2000 tons. Though none of these ships has yet been photographed, from such particulars as have been received they appear to be an enlarged edition of preceding designs. At least 16 submarines of from 1500 to 2000 tons are believed to have been begun since 1937. Otherwise, the Imperial Japanese Navy has recently been busying itself with the construction of small minelayers, gunboats, submarine chasers, and minesweepers.

France

The first French battleship of 35,000 tons, the "Richelieu," was launched a year ago, her place on the slip at Brest having since been taken by a sister ship, the "Clemenceau." A third ship of the class, the "Jean Bart," is building at the Penhoët Yard, St. Nazaire. A fourth vessel, the "Gascogne," will be begun shortly, if indeed she has not already been laid down. Particulars of these ships were given in THE ENGINEER of January 13th, 1939. Both the new 18,000-ton aircraft carriers, the "Joffre" and "Painlevé," have been ordered from the Penhoët firm. They are to be 774ft. in length with a beam of 111ft. The armament is expected to be eight 5·1-in. guns on high-angle mountings. The second and third of the three 8000-ton cruisers under construction have been begun, the "Chateaurenault" at La Seyne, and the "Guichen" at Bordeaux. Four more super-destroyers of the "Mogador" type have been ordered, the "Desaix" from Lorient Dockyard, the "Hoche" and "Marceau" from the Chantiers de Bretagne, and the "Kléber" from the Chantiers de France. Twelve destroyers of "Le Hardi" class, of 1772 tons, have now been ordered, the name ship being complete; and the number of lighter destroyers of "L'Agile" class, of 994 tons, has been increased to 14, though none has yet been reported as launched. Altogether 25 submarines are under construction, comprising five of the "Morillot" class of 1605 tons, 15 of the "Aurore" class of 893 tons, and four of the "Saphir" class of 669 tons. In addition, a new submarine to be named "Phénix" after the vessel of the same name lost in the Far East on June 15th, 1939, has been ordered as a replacement. Presumably she will be of the same type as the lost vessel, displacing 1379 tons. A number of the 26 minesweepers of the "Elan" class, of 630 tons, have been completed and are doing good service, as are two or three of the newest of the 18 submarine chasers ordered under the 1937–38 programmes. A ship of novel design, the "Impassible," was launched at Lorient on June 17th last. She is a wireless-controlled target ship of 2450 tons, with a speed of 20 knots, and is the first such vessel to be specially built for the purpose.

Italy

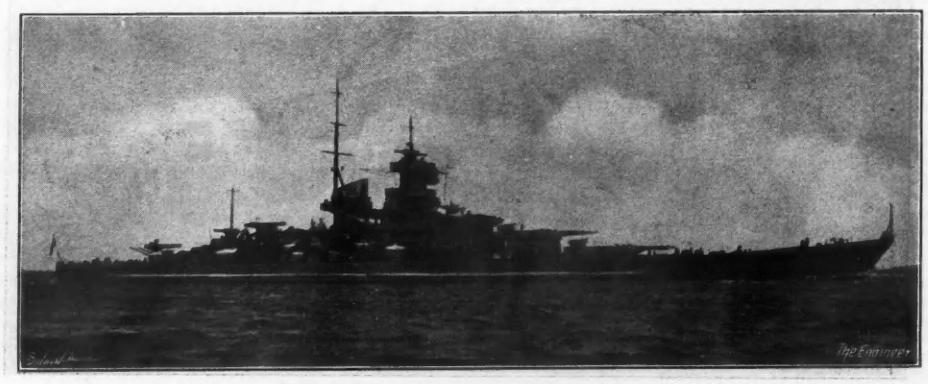
In December Italy completed her first pair of 35,000-ton battleships, the "Littorio" and "Vittorio Veneto," the former of which is illustrated herewith. They have been a little over five years under construction, having been laid down in October, 1934. With a length over all of 775ft., a beam of 106½ft., and a mean draught of 28ft., they are propelled by Parsons geared turbines of 130,000 S.H.P., equal to a speed of 30 knots. Trials are stated to have given higher speeds than this. The third ship of this class, the "Impero," was launched from the Ansaldo Yard on November 15th, and promises to be completed in less time than her two predecessors. Good progress is also being made at Trieste with the fourth ship, the "Roma." The reconstruction of the old battleships "Duilio" and "Doria" is said to be approaching completion. In armament they will differ slightly from the "Cavour" and "Cesare," rebuilt in 1933–37, as they will mount ten 12·6-in., twelve 5·3-in., and ten 3·5-in. guns. Official particulars of the twelve small cruisers of the "Regolo" class show them to be ships of 3362 tons displacement, other particulars being: length 444ft., beam 44¾ft., mean draught 13ft.; armament, eight 5·3-in., and six 65 mm. guns and eight torpedo tubes. Geared turbines of 120,000 S.H.P. are designed to give them a speed of 41 knots. Two cruisers were provided for under the 1939 programme, of which one, the "Ammiraglio Costanzo Ciano," is believed to have been ordered. It is thought they will be ships of 8000 tons, with a main armament of ten 6-in. guns, resembling the "Garibaldi" type in their main features. Eight destroyers and four torpedo boats are to be built under the 1939 programme, and a large number of submarines are under construction. Nine submarines of the "Marcello" class, and three of the "Galvini" class are understood to be in service. Six of the "Marconi" class, two of the "Cappellini" class, and four of the "Liuzzi" class have been launched, and should soon be complete. Eight of the "St. Bon" class, of 1461 tons are also building, these being the biggest submarines yet built for the Royal Italian Navy. Their most remarkable feature is that they are armed with fourteen 18-in. torpedo tubes. Six more of the "Cappellini" class were ordered recently. With the exception of the obsolescent "H" and "X" classes, all existing Italian submarines have 21-in. tubes. A number of additional submarines are believed to be provided for under the 1939 programme, but no orders for these have so far been announced.



GERMAN HEAVY CRUISER "HIPPER"

Germany

When the war began Germany had under construction four battleships of 35,000 tons, of which two, the "Bismarck" and "Tirpitz," were launched in the early part of 1939. The remaining pair have been rumoured to be 40,000-ton ships, but this statement is doubtful. Germany's only real battleships in service are the

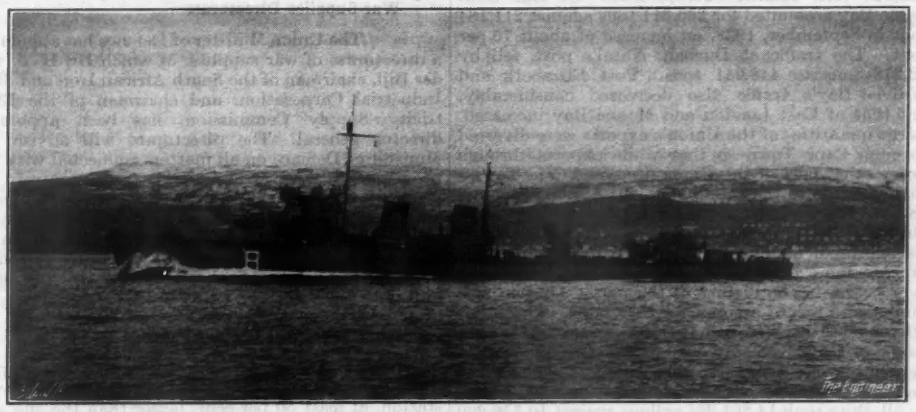


GERMAN BATTLESHIP "GNEISENAU"

"Scharnhorst" and "Gneisenau" of 26,000 tons, described fully in THE ENGINEER article on naval construction a year ago. Apparently these ships were found to be somewhat wet forward in a seaway, with the result that the bow has been rebuilt as shown in the accompanying engraving of the "Gneisenau." A cinder screen has been added to the funnel, presumably to render the bridge structure and control stations more habitable with a following wind. No news has been received of the launch of the second aircraft carrier, nor of the completion of the first, the "Graf Zeppelin," and it would not be surprising if work on these two ships has been suspended as a result of the war. Two 10,000-ton cruisers, the "Blücher" and "Hipper," armed with 8-in. guns, have been completed, though one of them is believed to have been seriously damaged by the torpedoes of H.M.S. "Salmon." The "Prinz Eugen" of the same type should be ready for sea in the course of the present year. Two more ships of this class, the "Seydlitz" and "Lützow," were launched in the course of 1939. Previously reported as 6-in. gun ships, they now prove to be sisters of the "Prinz Eugen." A photograph of the "Hipper," is reproduced herewith. Four 8000-ton cruisers, armed with 5·9-in. guns, are under construction; two of these may have been launched by now. Six destroyers of 1811 tons were completed when war began, and the remaining eight of this type are due for launching. Slower progress seems to have been made with the 30 torpedo boats of 600 tons, though over a dozen of them had been launched before the war. Practically all the 71 submarines mentioned in last year's article were in service or on the point of commissioning at the outbreak of hostilities, and 28 more were then under construction. Two of these are believed to be minelayers of about 1150 tons. Assuming that all were completed by the end of 1939, this would give Germany a total submarine strength of 99, to which must doubtless be added two small submarines which were under construction at Kiel for the Yugoslav Navy. How many of the total remain intact it is impossible to say, but conservative estimates place the number destroyed at about 40.

Russia

Though it has frequently been reported that the first of the projected battleships of 35,000 tons was laid down at Leningrad in 1939, and that a second has been begun at Nikolaiev, these reports should be received with caution, though it is true that a naval commission has visited the United States in connection with the purchase of the necessary material. A new cruiser of 8500 tons, the "Maxim Gorki," was delivered during 1939, but there is no news yet of the completion of the remaining two ships of this class. The cruiser-minelayer "Marti," at one time supposed to be a new ship, proves to be the former ex-Imperial Yacht "Shtandart," launched in 1895, which has been re-built and re-armed. Russia is believed to possess nine very large destroyers of about 2900 tons, but only four of these, the "Leningrad" and "Minsk" in the Baltic, and the "Moskva" and "Tashkent" in the Black Sea, are known to have been commissioned. Of the remaining five, four are believed to be completing in Black Sea yards, and one, the "Volochevka," at Vladivostok. Nine or more single-funnelled destroyers of the "Stremitelni" class, originally reported as vessels of 2600 tons, now prove to be little more than half this displacement. Like the "Tashkent," they are of Italian design. There seems little doubt that the total of 170 submarines, so persistently reported, is approximately correct, though a considerable percentage of these are quite small craft. Many of these are apparently also designed in Italy. The Soviet Navy appears to include a large number of 500-ton patrol vessels fitted for mine-sweeping, several of which proceeded to the Far East in the course of 1939.



YUGOSLAV DESTROYER "BEOGRAD"

Other Navies

In Holland a second ship of the "Tromp" type, officially rated as a flotilla leader, though actually a cruiser of 3350 tons, was launched in September and named "Heemskerck." Two cruisers of 8350 tons, to be named "De Zeven Provincien" and "Kijkduin," were ordered in February 1939; particulars of these ships were given in THE ENGINEER a year ago. Other new construction in hand for the Royal Netherland Navy includes four destroyers, seven submarines, seven gunboats, 30 motor torpedo boats, six minesweepers, and an oil tanker, the largest Dutch naval programme on record.

In South America, programmes of naval construction have been held up to some extent as a result of the war. Argentina is completing two escort vessels and a transport at Rio Santiago, while Chile is building a coastguard vessel of 1026 tons at Valdivia. Brazil has three destroyers of 1500 tons under construction at Ilha das Cobras, Rio, with material imported from the U.S.A. Six destroyers which were building in British yards have been taken over for the Royal Navy, as stated in the first part of this article.

Sweden has begun two new coast defence ships, officially rated as battleships, of which an illustration appears below. They are to be ships of 8000 tons, with a length of 436ft., beam 64ft., and draught 18¾ft., a speed of 23 knots, and an armament of four 10-in. and six 4·7-in. guns. Their cost is estimated at 37,000,000 kroner apiece.

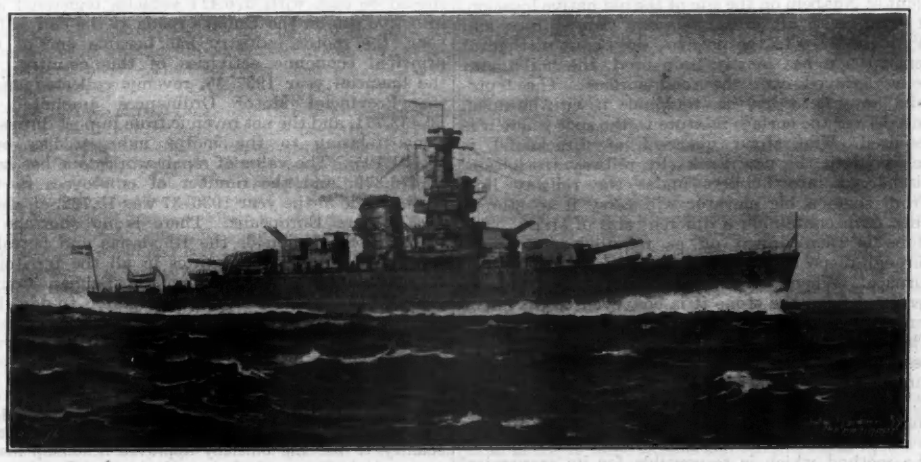
Norway, after having launched half a dozen torpedo boats of 597 tons, laid down at Horten last year two destroyers of 1220 tons, with a speed of 34 knots, and a main armament of four 4·7-in. guns and four torpedo tubes.

Denmark has two coast defence ships of 7000 tons projected, but there is no news of their having been laid down yet.

Greece, having taken delivery of two Yarrow-built destroyers last year, is now laying down two more of the same type, corresponding to the British "Hero" class, in her own naval yard.

The Yugoslav Navy recently added three destroyers of French design, with Yarrow engines and boilers, to its strength. One of these, the "Beograd," is illustrated herewith. On a displacement of 1210 tons, she develops 40,000 S.H.P., equal to a speed of 38 knots.

Thai (otherwise Siam) has ordered two cruisers of 4200 tons from the Adriatico yard, Trieste. These vessels, which are to have a speed of 30 knots, and a main armament of six 6-in. guns, were laid down in August and September last.



SWEDISH COAST DEFENCE SHIP

Obituary

EDWARD LEWIS ATTWOOD

MANY of our readers, who are interested in naval architecture, will learn with regret of the death on Monday, January 1st, at his home, 35, The Drive, Ilford, Essex, of Mr. Edward Lewis Attwood. He was the author of several standard works on naval architecture, and after a distinguished career in the Royal Corps of Naval Constructors served as Deputy Director of Naval Construction from 1930 to 1932, when he retired. He was born in 1871, and served his apprenticeship with R. and H. Green, of Blackwall, and the Thames Ironworks. In 1892, he obtained a scholarship at the Royal Naval College at Greenwich. Three years later he was admitted to the Royal Corps of Naval Constructors, and was appointed to Chatham Dockyard. Not long afterwards he was appointed to the Design Staff at the Admiralty, and in 1899 was promoted to the rank of Assistant Constructor, Second Class. It was in that year that he wrote and published "A Text Book of Theoretical Naval Architecture" which was immediately successful and went into many editions. Two years later Mr. Attwood's teaching ability was recognised by his appointment as Lecturer on Naval Architecture at the Royal Naval College. In 1904 he obtained the senior college appointment of Instructor, a post which he continued to hold until 1907. In these years he found time to write other books, amongst which we may recall "Warships," "The Modern Warship," and a small manual dealing with the geometrical side of shipbuilding entitled "Laying Off." In 1909 he left the teaching side of his profession to become principal Admiralty Overseer in charge of the construction of H.M.S. "Hercules," on the completion of which ship he occupied the same position during the building of H.M.S. "Queen Mary." In 1912 he was called back to the Admiralty, and given the rank of Constructor, and from 1915 onwards he acted as Chief Constructor. In 1924 he was appointed Assistant Director of Naval Construction, and gave valuable assistance to the Directors under whom he served, Sir Eustace T. d'Eyncourt and Sir William Berry, in the design of the battle cruisers "Repulse," "Renown," and "Hood," and was personally entrusted with the designs of the battleships "Nelson" and "Rodney," in the construction of which many lessons gained in the last war were embodied. In 1930 Mr. Attwood was appointed Deputy Director of Naval Construction, a position which he occupied for a period of two years and then retired. He was a member of the Institution of Naval Architects, and served on the Council in 1930 and 1931.

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South African Engineering Notes

(By our South African Correspondent)

Union's Harbour Trade

During the month of September the total quantity of cargo loaded and discharged at Union ports showed a big increase over the figures for the same month in last year, the total quantity being 944,820 tons against 828,935 tons. Of this total Table Bay accounted for 365,311 tons against 211,184 tons in September, 1938, an increase of about 75 per cent. The traffic at Durban, Natal's port, fell by 42,278 tons to 448,041 tons. Port Elizabeth and Walvis Bay's traffic also decreased considerably, but that of East London and Mossel Bay increased. Large quantities of the Union's exports were diverted through Cape Town so that while exports through every other port of the Union decreased Cape Town's share was more than double at 201,857 tons against 98,227 tons. Imports through Table Bay were almost half as much again as in September, 1938. As expected, because of the closing of the Mediterranean, more oil was bunkered at Table Bay than ever before in the history of the port. Durban also bunkered a record amount for that port. Two other effects of the war were seen in the decrease of passenger traffic at all ports—only 5516 arrived against 7897 in September last year, and 2314 sailed against 5604—and the big increase in the demand for fresh water. In all, ships took 14,291,225 gallons against 10,759,200 gallons.

Increasing "Iscor's" Plant

In last month's notes it was announced that the South African Iron and Steel Industrial Corporation (Iscor) was increasing the capacity of its Pretoria Works by erecting a new battery of coke ovens and a by-product plant, and that the steel ingot output was being increased by 100,000 tons a year. This increase of 100,000 tons will be obtained by the installation of a converter plant to work in conjunction with the works open hearth furnaces, under what is known as the "Duplex" process. The directors of "Iscor" have also decided to proceed with the erection at the works of an up-to-date wire works for the production of all commercial grades of steel wire. Investigations as to the plant to be installed and the planning of the works are in progress but war conditions may determine when a start can be made with construction work. Developments and improvements have not been confined to increasing the total steel output. A good deal of attention has been devoted to, and considerable sums spent in, extending the throughput capacity of the different divisions, particularly in the several finishing departments, so as to increase the flexibility of the works, and enable it to cope effectively with changes in the types of products in most urgent demand. The directors have been giving special attention to the question of the local manufacture of spare parts for replacements and many items of plant and equipment which had previously been purchased overseas. Towards this end extensions to the foundry and the machine shops have been provided for, and a larger expenditure incurred in installing additional and up-to-date machine tools. These improvements involved the use of the boiler and erecting shop for other purposes, and instead of building a new and enlarged boiler shop it was decided by arrangements with the other shareholders in the Pretoria Steel Construction Company (Pty.), Ltd., to purchase their holding in that company, and to take over for use as a boiler and erecting shop the properties, works, and plant of that company which are adjacent to Iscor works. Approximately £200,000 has been spent or provided for over the last eighteen months or two years with the object of making the works independent of overseas supplies and generally for safeguarding the industry against the possibility of the stoppage or restriction of overseas supplies.

While the extensions to "Iscor" will help, South Africa will only be able to supply about one-third of the country's total steel requirements, and will be dependent upon overseas sources for the bulk of its steel requirements until something can be done on a bigger scale to increase steel production and to extend the range of steel products manufactured in South Africa. This aspect has been engaging attention, but it has been necessary to postpone consideration on the matter until the effect of war conditions can be more clearly gauged, particularly in respect of plant deliveries and of prices. The contract for a new Bessemer plant has been placed by the Corporation with a Glasgow firm. The new plant will comprise a 750-ton inactive mixer, two 25-ton Bessemer converters, a turbo-blower, and a bottom-making plant.

Iscor's Production and Profits

During the year ended June 30th, 1939, the production of steel ingots by "Iscor" totalled 344,267 tons, an increase of over 12,000 tons compared with the preceding year. In the case of the sheet-works, the production of sheets and light plates increased from 49,544 tons in 1937–38, to 57,612 tons during the year ended June 30th last. The total tonnage and value of all products despatched during the year was 335,264 tons, while the net sales revenue was £3,528,065. Of this amount 82·4 per cent. came from merchants, mines, industries, and other customers, 15·6 per cent. from the Railways Administration, and 2 per cent. from Government and Provincial Administration. The manufacturing profit earned by "Iscor" for the year ended June 30th, 1939, was £1,189,434 compared with £1,236,122 for the previous year, and £669,279 for the year ended June 30th, 1937. Sales of "Iscor" pig iron amounted to 22,276 tons during the year.

War Supplies Directorate

The Union Minister of Defence has appointed a directorate of war supplies, of which Dr. H. J. van der Bijl, chairman of the South African Iron and Steel Industrial Corporation, and chairman of the Electricity Supply Commission, has been appointed director general. The directorate will advise the Minister of Defence on all matters connected with the provision of war supplies. It will control the acquisition of all goods required by the defence forces, enter into contracts on behalf of the Government for requiring all such goods, and the construction or acquisition and distribution of the skilled personnel necessary for defence, for both military and industrial purposes.

Huge Electrical Project Planned

If the normal development of the City of Cape Town is not retarded, a third large power station, at least 50 per cent. larger than the one now being erected, will be proceeded with in a couple of years or so on the Cape Town side of the Salt River Station (Paarden Island). Two-thirds of the first section of the new Table Bay power station has been in commercial operation since April. The completed first section costing £2,250,000 will be put in hand as soon as the rapid development of the City of Cape Town calls for it. This station is inter-connected with that of the Electricity Supply Commission's power station at Paarden Island which contains generating plant with a capacity of 90,000 kW. The completion of the second section of the Table Bay power station will extend the power station buildings up to the boundary of Dock Road, and will entail the demolition of the existing office buildings and old feather market block in Dock Road. It will also necessitate the erection of a second chimney stack equal in size to the one already there, which is 300ft. in height. By the time the completed station, representing £30,500,000, is in operation it will be time for the erection of the third, and much larger, power station. The site for this new giant station has been planned on the city side of the Salt River power station, and the salt water intake duct now being built by the Dutch contractors in conjunction with the shoreward section of the mole of the new harbour scheme, at a cost of more than £300,000, has been planned to supply this power station of the future as well as the existing power station near the Salt River mouth. As a temporary expedient to avoid heavy capital expenditure now, this new intake duct will be carried from a pumping station on a bridge to be erected across the mouth of the Salt River to the existing power station. When the future power station is completed the intake water will be gravitated to both stations in pipes laid beneath the bed of the river. It is hoped that water from this intake will be available for the Salt River power station before next winter as there is a possibility that the existing "pill-box" intake—which became silted up and gave serious trouble two winters ago—may again give trouble as the harbour scheme progresses.

Non-Skid Roads for Cape Town

At present, Cape Town's £40,000 new municipal bitumising plant, the biggest in South Africa, will undergo its final tests. Not only will the plant greatly increase the output of "pre-mix" for road surfacing—which gives one of the finest non-skid surfaces known—but its operation is so economical that it is expected to save the municipality up to £1000 a month. The plant is the first unit in the municipal scheme to centralise its road construction plant at Ndabeni on the site of the old native location. It will serve all areas between Camps Bay and Wynberg. Up to the present, the Grout method of construction has mostly been used, the boiling tar being sprayed over the road surface. The "pre-mix" way is to dry the stone, mix it with bitumen, and deliver the surface mixture to the spot where it is required. The stone quarried at Brackenfel is delivered to the new works by railway trucks and discharged into hoppers under the railway line. From there a big elevator will carry it to storage bins, each containing a different size of stone. The stone is then drawn off as required and passed through a special stone drier which is fired by an oil furnace. When the unnecessary moisture has been removed from the stone it is conveyed to dry stone bins and then discharged into a travelling mixer. This mixer is an extremely important part of the assembly. It travels on rails beneath the dry stone bins and the correct amount of stone is weighed into it. An accurately determined amount of bitumen is then added, and the "pre-mix" conveyed to bins from which lorries are loaded. It is the accuracy of the method which is responsible for its economical operation. The minimum of bitumen is used—a particularly important consideration at present, for all supplies come from overseas. As a safety device, all electrical controls are interlocked. If a conveyor fails, for instance, all electrical mechanism before that point is automatically cut out to prevent supplies piling up at the stoppage. The total output of the plant is 300 tons of "pre-mix" a day, and there is provision for an extension when it is required. The large number of new estates which are being opened up, and consequently of new roads that will have to be built, will result in a very heavy road construction programme in the next few years.

S.A.R. Places Contracts

Railway services in the Union are to be expanded to the fullest extent. Several important buying contracts are at present under consideration. Tenders are being invited in many countries, including Australia and America, for the supply of certain essential materials unobtainable in South Africa. The first order to be placed will probably be for about 8000 tons of steel products at a total value of about £250,000, but no decision has been reached as to where the contract will be placed. No difficulties are anticipated in arranging the necessary shipping facilities to and from South Africa to meet all the country's needs, and there is a possibility that certain shipping lines may start services between the Union and the United States, including Dutch and Italian companies.

Modern Railway Station for Durban

Durban is to have a new central railway station, and the workshops in the heart of the city are to be removed to Umbilo, at an approximate cost of £2,000,000. The workshops and stores areas cover 47 acres, and the total capital value of the buildings, ground, machinery, and plant is £884,908. A staff of 2122 is employed there and the wage bill is £491,638. Provision is also to be made for a native station.

Union's Industrial Expansion

The industrial expansion of the Union, in spite of the war, is well illustrated by the number of new factories registered during September, and the wide range of additional manufactures now being undertaken on the Witwatersrand and elsewhere in the country. For instance, a firm in Johannesburg has begun to manufacture electrical heating elements, and a local factory has extended its operations to include the making of unit heaters and ventilators. A new factory is now manufacturing cycle frames in Johannesburg. Among the new factories registered in Johannesburg in September were factories for the manufacture of jewellery, toilet requisites, wire goods, furniture, brooms and brushes, yeast, clothing, and mattresses. In Pretoria, there are to be new factories for furniture and joinery, in Springs for kaffir trunks, in Krugersdorp for sheet metal, in Kimberley for bricks, in Bloemfontein for sweets, and in Bethal for mineral waters and vehicle building. The manufacture of edible oil is now being undertaken by a Pretoria firm, a factory has been opened in Cape Town for making wooden parquet blocks, and in a new Durban factory steel windows are to be produced. Another Durban firm has begun operation in new premises as manufacturers of special aerated waters; extensions to the new premises of an iron works in Durban have been completed. Altogether sixteen established industrial concerns in the Transvaal have moved into new buildings, and plans have been passed for additions to, or new premises for, existing factories engaged in Johannesburg in the manufacture of furniture, cardboard boxes, dry cleaning, baking and biscuit manufacture, clothing and shirt manufacture, and chemicals and soap production. Extensions are also planned by two engineering firms in Johannesburg, and by sheet metal workers on the West Rand.

The Motor Industry in the Union

It is perhaps not as widely appreciated as it should be that with 376,414 vehicles registered and in active use on the Union's roads at the end of last year, the motor industry has become one of the principal economic activities of this country. In the financial year 1937–38, revenue collected under the Provincial Motor Ordinances amounted to £2,433,771, and the net revenue from import duties on items relating to the motor industry has been £4,521,195. The value of repair work done has been £9,476,379, and the number of employees in the motor trade in the year 1936–37 was 15,792, of whom 10,372 were Europeans. There is no shortage of pterol in the Union or the Rhodesias and petrol is available in normal quantities in all the territories in Southern Africa including the Belgian Congo. The price of petrol is 1s. 6d. per gallon to-day, but may rise a penny or so later.

MOTOR CAR HEADLAMPS.—On and after Monday, January 22nd, it will be compulsory for motorists in this country to use the officially approved headlamp mask, or one giving an equivalent performance. It is stated that the mask may be fitted to either of the headlamps.

Rail and Road

MINISTRY OF TRANSPORT APPOINTMENT.—The Minister of Transport has appointed Sir Arnold Musto, Regional Transport Commissioner for the Midland Region in succession to Mr. Edgar Macassey, resigned.

TUBE TRAIN ACCIDENT.—When a Piccadilly line train collided with a Metropolitan line train at Hillingdon on Monday, January 1st, the driver of the former train was trapped in his cabin and subsequently died of his injuries.

DERAILMENT ON L.M.S.—The London, Midland, and Scottish Railway's main line between London and Leicester was blocked for nearly three hours on Thursday, January 4th, when an engine and several empty coaches were derailed outside Market Harborough Station.

LONDON BUS SERVICES.—As a result of experience the London Passenger Transport Board has revised its war-time bus schedules, and has placed in service on the central routes 700 more vehicles than were running at the time fuel rationing was introduced. It is also announced that further adjustments are to be made to routes to meet the new conditions and requirements as they are noted.

SOUTHERN RAILWAY APPOINTMENT.—The directors of the Southern Railway Company have appointed Mr. R. M. T. Richards, Assistant Traffic Manager to be Traffic Manager, as from January 1st, 1940, during the period in which Mr. E. J. Missenden (in the absence of Mr. Gilbert Szlumper, now Director General of Transportation and Movements, War Office), holds the position of General Manager of the Southern Railway.

BROOKLYN BRIDGE.—Authorities in New York have recommended a scheme for the rebuilding of Brooklyn Bridge so that it takes six instead of the present four lines of traffic. It is proposed that the anchorages, towers, and cables of the present bridge be retained and a new deck, suspension ropes, and stiffening girders should be installed. The work would cost about fifteen and a half million dollars, and take four years to complete.

HIGH TRAIN SPEEDS IN AMERICA.—According to a publication of the Association of American Railroads, the passenger schedules of railways in the United States now show a daily mileage of 54,956 run at 60 m.p.h. or more, made by 997 separate trains. If the 60 m.p.h. performances of the weekly and semi-weekly trans-continental services are included, the runs total 1070 with an aggregate mileage of 65,034. It is shown that American railways now have 85 runs booked at 70 m.p.h. covering a total distance of 8068 miles, all but 2156 of which are covered daily.

PROPOSED NEW INDIAN TRUNK ROAD.—A note in *Indian Engineering* says that according to present proposals it is recommended that the existing road between Hyderabad and Badin in Sind should be extended to Ahmedabad *via* Rahimki Bazar, Nager Parkar, Suigan, Radhanpur, and Viramgam, following largely the route which was under consideration in connection with the Railway project with an extension from Suigan to Deesa which would connect Sind with Rajputana and the North-East. It is further proposed that this road should be connected with Cutch State by linking up Baliari in Sind with Bhuj in Cutch State.

MANCHESTER-SHEFFIELD ELECTRIFICATION.—It is stated in the *Electrical Review* that although all the contract work in connection with the electrification of the line from Manchester to Sheffield is to be finished, the completion of the scheme is to be deferred. The project concerns just over 74 route miles and 292 miles of track, and was the first true main-line electrification scheme in Great Britain. About half the civil engineering work has been completed, and several miles of overhead equipment to carry the 1500-V transmission wires has been erected. When the scheme is eventually completed all freight and passenger trains will be hauled by electric locomotives, except for certain passenger services to be run by self-contained multiple-unit electric trains.

LARGE NEW AMERICAN LOCOMOTIVES.—Twelve 2–8–8–4 articulated passenger and freight locomotives have recently been placed in service by the Southern Pacific Railroad in the United States. These engines were built by the Lima Locomotive Works and have been designed for burning a low grade bituminous coal having a heating value of about 12,000 B.Th.U. per lb. The boiler which has a working pressure of 250 lb. per square inch varies in diameter from 97in. to 109in., the firebox being about 8ft. 6in. wide by 17ft. long, and the grate being over 139 square feet in area. The total evaporative heating surface is 6918 square feet, and with the superheater 9749 square feet. In full working order the engine weighs 689,000 lb. of which 265,500 lb. is on the front driving wheels, and 265,700 lb. on the rear driving wheels. The total engine wheel base is 66ft. 3in. long, of which 11ft. 4in. is rigid. The two cylinders on each of the two engine units are 24in. diameter by 32in. stroke and the driving wheels are 63½in. in diameter. The total rated tractive force of each engine is 124,300 lb.

NEW L.M.S. TIME-TABLE.—Further improvements in both the speed and frequency of passenger train services are contained in the London Midland and Scottish Railway Company's new time-table which came into force on Monday, January 1st. The time-table provides for additional important main line services, and the speeding-up of 65 express trains to effect a total daily saving of 31 hours in journey times. In addition, the night sleeping-car services are restored between Birmingham, Liverpool, Manchester, and Glasgow, whilst the number of trains, already more than 500, having reading-light equipment, is being progressively increased as equipment becomes available. Amongst the many important weekday services accelerated are the day trains between London and Scotland, the 10.0 a.m. from Euston arriving Glasgow at 6.45 p.m. (61 min. acceleration). The corresponding morning express from Scotland will arrive Euston 6.50 p.m. —82 min. quicker from Glasgow, and 77 min. from Edinburgh. The 10.0 a.m. from St. Pancras will be 44 min. faster on the journey, and the corresponding southbound train from St. Enoch (altered to leave at 10.0 a.m. instead of 9.50 a.m.) will be 61 min. faster.

Miscellanea

PORTSMOUTH POWER STATION EXTENSIONS.—In view of the substantial reduction in demand for electricity, the Central Electricity Board has decided to defer the scheme for the extensions to the Portsmouth generating station.

ASWAN DAM POWER SCHEME.—The Egyptian Government has concluded its discussion on the Aswan Dam power scheme, but its decision has not yet been announced. This scheme was proposed two years ago and involved an expenditure of some seven million pounds for the setting up of an extensive generating plant using power from the Aswan Dam.

MR. E. R. CLARKE.—At a complimentary dinner given recently at the Dorchester Hotel, Mr. E. R. Clarke, the senior director of G. A. Harvey and Co. (London), Ltd. was presented with a canteen of silver to commemorate his recently completed fifty years of service with the Company—he joined the firm as a boy in 1889, and became a director when it was formed into a limited liability Company in 1914.

BRUSSELS INTERNATIONAL INDUSTRIES FAIR.—Despite the war it is the present intention to hold an International Industries Fair in Brussels from March 6th to 17th, 1940. In connection with the Fair, a "Belgian Review of International Trade", in Dutch, English, French, German, Italian, Portuguese, and Spanish which will in fact be a detailed illustrated catalogue is to be published, and will be forwarded, free of charge, as long as the supply lasts. The offices of the Fair organisation are in the Palais du Centenaire, Brussels, 2.

OVERSEAS TRADE.—During November last, goods to the total value of £37,360,327 were exported from the United Kingdom, whilst the imports totalled £83,988,000. Group summaries of engineering products exported during the month are as follows, and the totals for the ten months ended on November 30th, are given in brackets:—Machinery and parts thereof, £3,297,000 (£43,694,000); vehicles, including locomotives, ships, and aircraft, £2,618,000 (£36,373,000); iron and steel, £2,221,000 (£30,093,000); non-ferrous metals and manufactures thereof, £787,000 (£11,928,000).

ARC WELDING AND PROGRESS.—A 2½ year programme of scientific study, which will culminate in payment of $200,000 in awards, has been announced by The James F. Lincoln Arc Welding Foundation, of Cleveland, Ohio. The awards will be made for studies bringing out benefits of a social, economic, or commercial nature, such as reduction or elimination of hazards to safety and health, greater availability of comforts and conveniences through reduced prices, greater utility and durability of machines and structures, as well as industrial benefits such as cost savings and other advantages in manufacture, fabrication, or construction.

VETERAN CROMPTON GENERATOR.—A veteran Crompton D.C. Generator, over 40 years old, is still in use at a works in Chesterfield. It is a bi-polar machine with wrought iron magnets and its output is 75 kW, 220 volts, at 560 r.p.m. The generator is used for twelve hours every day, and it is capable of carrying a 50 per cent. overload for many hours when the occasion arises. In spite of its long history the fact that friction wear has been negligible is shown by the fact that the original bearings and commutator are still in service. The method of driving has been changed at intervals. It is now driven by a synchronous motor through a gear box.

AN EXPERIMENTAL FOUNDRY IN AMERICA.—An experimental foundry is being built by the Research Foundation of the Armour Institute of Technology intended for the purpose of advancing the method of counter gravity die casting of iron and other high melting metals. According to the *Iron Age* the process to be studied consists of forcing the molten metal by air pressure through a refractory tube into the mould which is located over the crucible. This method is claimed to be superior to gravity flow sand mould practice. The tensile strength of a gray iron casting obtained is said to be about 40,000 lb. per square inch, the grain being finer and the surface smoother.

AUSTRALIAN POWER PROJECT.—A note in the *Electrical Review* says that a conference has been held at Bombala between representatives of New South Wales and Victorian municipalities with a view to developing the hydro-electric resources of the Snowy River. In a recent report to the N.S.W. State Government, Rendel, Palmer, and Tritton, consulting engineers, put forward proposals for a hydro-electric scheme on the Snowy River between Jindabyne and Biddi Point to supply 300,000 H.P., including transmission to Sydney over a distance of 265 miles. This scheme would make use of the fall of the river in N.S.W. territory. It is contended that equally good facilities are available for making use of the fall on the Victorian side, and it is with the object of developing such a scheme that the conference was called. The Monaro and East Gippsland country which would benefit by this scheme embraces 33,490 square miles. It is proposed to distribute energy around the coast from Eden to Bairnsdale.

HARDENING CYLINDER BORES.—An American company has introduced an electrical induction method of hardening the inside of cylinders and other bores. The process enables the heat treatment of inside diameters from two inches and over, and in lengths limited only by the design of suitable equipment. According to *Iron Age* the area treated, depth of treatment, and degree of hardness are controlled within very close limits. Where the area to be treated is of considerable length, a retracting head is used which heats the material by electrical induction. This head is drawn through the cylinder and is followed by a water quench. An important feature claimed for the process is that the outside diameter, and all other unhardened areas, may be machined after heat treatment of the bore. Sections of bores which need to be hardened can be treated while other parts can be left in a machinable condition. The whole hardening operation is performed in from one to three seconds and the short heat cycles, in combination with the instantaneous quench, reduces oxidation to a minimum.

Air and Water

SHIPPING LOSSES.—During the week December 24th–30th, three British and two neutral ships aggregating 4,699 tons were sunk.

DUTCH NAVAL EXPANSION PLANS.—It is reported that Dutch Naval experts are in favour of the construction of three battleships of about 31,000 tons displacement for permanent duty in Eastern waters.

NAVAL AIDE-DE-CAMP TO THE KING.—Engineer Captain D. C. Bennett has been appointed a Naval Aide-de-Camp to H.M. the King, from November 30th, 1939, in succession to Engineer Captain C. J. Gray, who has been placed on the Retired List.

TRANS-ATLANTIC AIRCRAFT ORDERED.—Reports from the United States say that an order, valued at two million dollars, has been placed with United Aircraft for the initial work on three large flying boats for non-stop service to Europe. Plans have been prepared by the Pan American Airways for a daily air service across the Atlantic within the next three months.

FAST PATROL CRAFT FOR EIRE.—The Government of Eire is forming a small fleet of swift patrol boats to protect its territorial waters. Orders have been placed with a Southampton firm for motor torpedo boats and other types of fast armed patrol boats to a total value of £250,000, and a special mission is to come to this country to take delivery of the first batch of ships.

BRITISH CONTRABAND CONTROL.—During the week ending December 30th the British Contraband Control intercepted 20,800 tons of contraband goods suspected of being destined for Germany. This total included: 17,500 tons of petroleum and allied products, and 1450 tons of ores and metals. In the first seventeen weeks of war, the British Contraband Control has now detained a total of 537,600 tons.

NEW FRENCH AERO-ENGINE.—A note in *Flight* says that the well-known automobile designer, Bugatti, is reported to have completed the design, in France, of an almost flat double-eight aero-engine of 1500 H.P. The cylinders are of cast light alloy with steel liners, and the engine has overhead camshafts and a centrifugal blower. Reduction gearing, permitting the driving of one or two airscrews, is provided. Frontal area is said to be very low, and the engine is suitable for mounting in wing or fuselage. The output of 1500 H.P. is obtained at 3000 r.p.m., and a dry weight of 1 lb. per H.P. is claimed.

AIR LINER DISASTER REPORT.—The report on the accident to the British Airways air liner which last August caught fire in the air and came down in the waters of the Storstrom, has been issued by the Air Ministry. The investigation was conducted by the Danish Authorities, and its findings have been agreed to by the Air Ministry Chief Inspector of Accidents. Four passengers and one member of the crew lost their lives, only the pilot being saved. It was found that the fire was caused by the ignition of petrol vapour either in the wing space on the port side, or in the cabin. This vapour was caused by petrol leaking from the overflow boxes into the wing space, and this in turn was due to overfilling of the tanks. What caused the ignition of the vapour could not be ascertained.

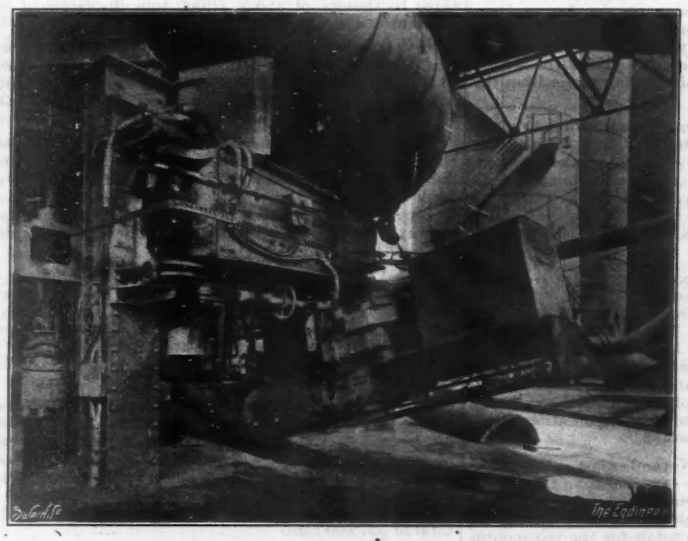
THE LIFE-BOAT SERVICE IN 1939.—Life-boats were launched more often in 1939, and more lives were rescued from shipwreck round our coasts, than ever before in the history of the service. Life-boats were launched 677 times, and the Royal National Life-boat Institution gave rewards for the rescue of 1356 lives. The previous largest number of launches was 485 in 1938. The previous largest number of lives rescued was 1348 in 1917. By far the greater number of these launches have been made and these lives rescued since the outbreak of war. From September 3rd to the end of the year there were 411 launches, and 1101 lives were rescued. Seventeen new motor life-boats were completed and sent to the coast during the year, and ten more are under construction. There are now 145 motor life-boats and 15 pulling and sailing life-boats round the coasts of Great Britain and Ireland.

PAYMENT OF LOST VESSELS' CREWS. The Government has decided to accept an offer which had been made on behalf of the shipowners, to share with them in equal proportions the cost of paying wages to all surviving officers and men whose ships are torpedoed, mined, &c., for a period of one month or until they reach this country, whichever should be the greater. The owners have further offered to supplement during the second month the compensation payable to those who are injured when their ships are lost, and the effect of this would be that where a man was in receipt of full disability allowance he would in fact receive full wages. Detailed arrangements will be embodied in a Ministry of Shipping notice to masters which will be published shortly. These payments will take the place of ordinary shipwreck unemployment indemnity. The arrangements are to be deemed to have become operative on December 1st, 1939, and to apply to all merchant ships lost by enemy action on and after that date.

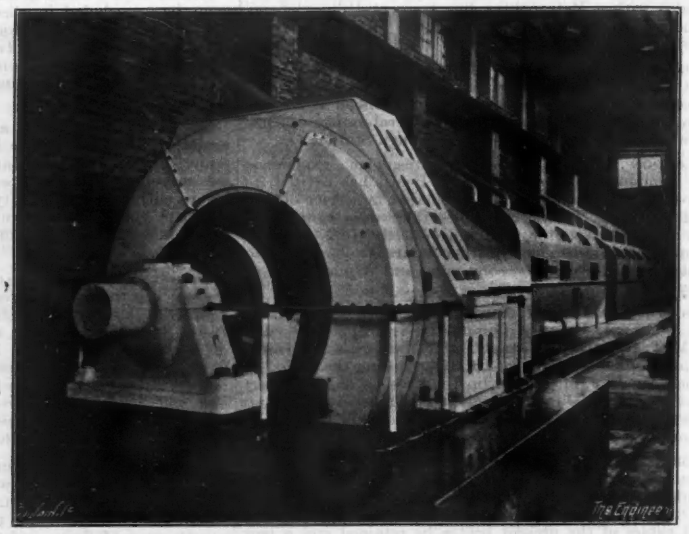
LINER TRADES SHIPS REQUISITIONING.—When the Minister of Shipping met representatives of the Chamber of Shipping and the Liverpool Steam Ship Owners' Association on Thursday, January 4th, he informed them that the Government had decided to take over all ships on the United Kingdom and Colonial register engaged in the deep sea liner trades. Most of the vessels concerned will be requisitioned as from February 1st, and those not taken over on that date will be requisitioned as soon as they have completed their first discharge in the United Kingdom after February 1st. The owners remain responsible for providing crews and for the upkeep of requisitioned vessels. The companies themselves will continue to manage and operate the ships, subject only to compliance with such instructions as to the cargo to be carried and programmes of routes to be adopted. The companies will account to the Ministry for all voyage receipts and expenditure, the profits or losses on the voyage undertaken being treated as on Government account.

ELECTRICAL PLANT OF 1939

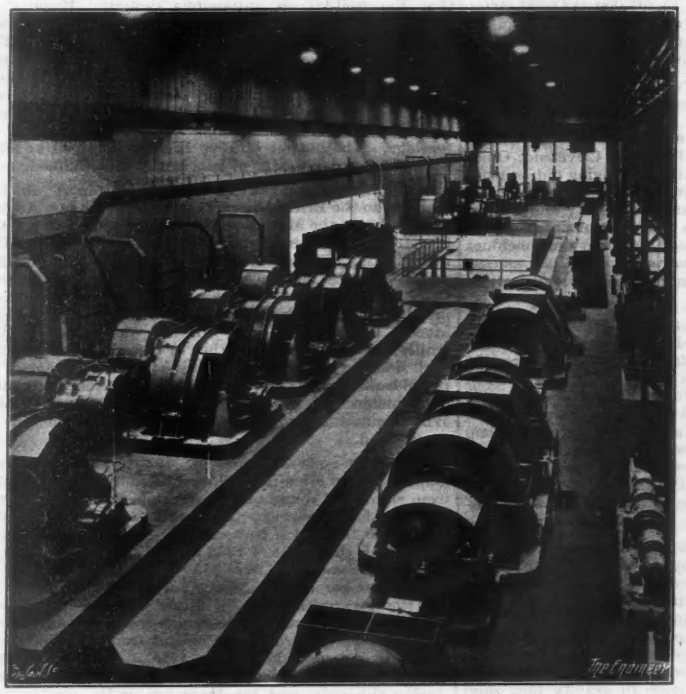
(*For description see page* 48)



CLAY GUN AT WORK ON BLAST FURNACE

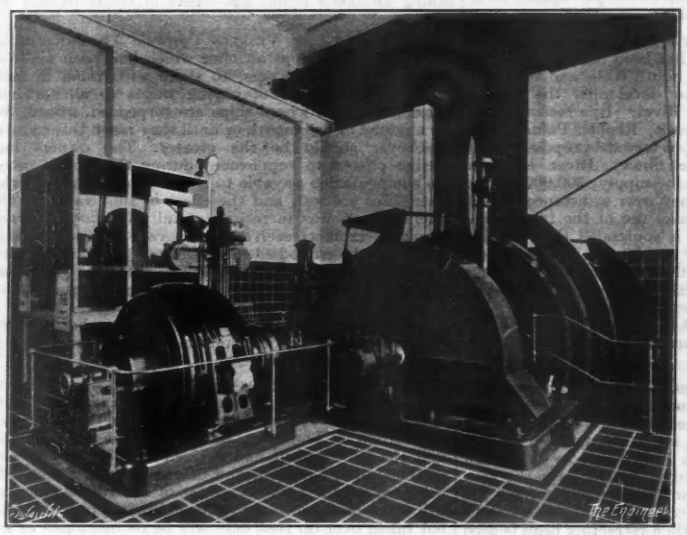


6000 B.H.P. INDUCTION MOTOR FOR CONTINUOUS BILLET MILL

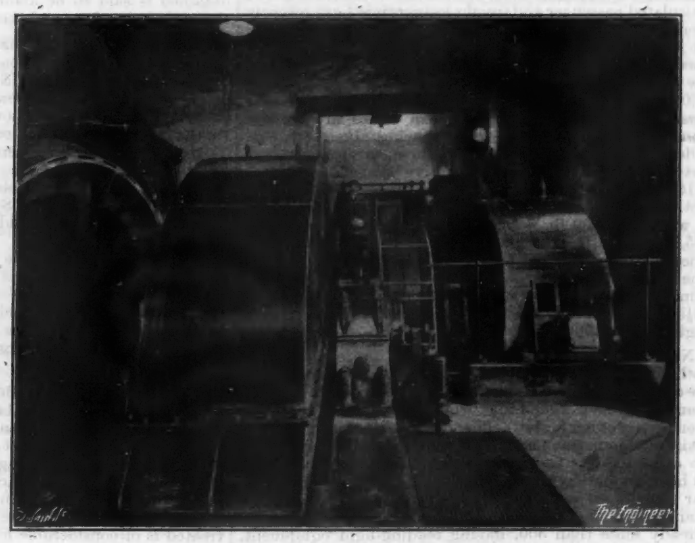


MOTOR ROOM OF WIDE STRIP MILL

LOCHABER HYDRO-ELECTRIC POWER STATION



WINDING PLANT AT CALVERTON PIT



1250 H.P. ELECTRIC WINDER AT A COLLIERY

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NOTICES TO READERS

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FRENCH ENGINEERING PRODUCTION

AT the beginning of 1939, French engineering industries emerged from the throes of a revolution that had paralysed them for two and a half years. Then they began to make a recovery under conditions that gave promise of important industrial developments in the future. Briefly, the labour revolution in the middle of 1936 swept away the old order of things and threatened a destruction of industrial initiative and progress. That danger awakened a reaction amongst manufacturers, who constituted a powerful defensive organisation which stemmed the tide of the Socialist onslaught. The labour agitation failed, but much of its legislation remained, and its effect upon engineering industries was to turn the attention of employers to the social interests of workers and to point out that new conditions can only be met by increasing production and lowering costs by means of suitable machinery and equipment that will augment the individual output of workers. The new Government had already prepared plans for a complete reorganisation of industrial production as part of a more general scheme for restoring financial stability and public confidence, which was a necessary preliminary to industrial recovery. That reform was accomplished successfully by giving more flexibility to a social legislation that could not be repealed and could yet be suspended by urgency decrees that may be prolonged indefinitely. In this way, all restrictions that interfered with the Government's plans were removed. The working week was extended to 48 hours and inducements were offered to manufacturers to bring their works up to a higher state of efficiency. It was an official campaign for more machinery and a heavier production for the home market and for export, and behind this drive to increase the country's production capacity was the necessity of preparing for a war that was growing imminent. Orders for war material were already being distributed. The past year, therefore, started with good prospects for the engineering industries, partly because credit had been restored and enabled undertakings that had been delayed or suspended to be put in hand, and partly on account of increasing military requirements. Of more importance to industry was a revival of confidence within itself through employers regaining their liberty and authority, subject to obligations affecting the rights of workers accorded to them by the labour charter.

Some idea of the character of work undertaken by big engineering companies is obtained from a report on the past financial year of a firm in the Nord, which states that contracts executed represented 33 per cent. for national defence, 46 per cent. for home industries, and 21 per cent. for export. The normal production of this firm is mainly machinery, boilers, bridge, and other structural work. The interest of these figures lies in the percentage of exports, which include shipments to the colonies. Most of the material exported has been for the execution of works in Africa, Indo-China, and other colonies, as well as in some foreign countries, and notably Poland before the war. Since the beginning of hostilities there has been no publication of foreign trade returns, and this omission confirms what is fairly obvious that the change from peace to war conditions temporarily relegated all questions of foreign trade to the background. Yet these questions obtruded themselves when it became evident that armament production will not alone win a protracted economic war, nor can there be hope of avoiding serious unemployment after the termination of hostilities unless goods are manufactured for trade with foreign countries. Any immediate continuity of civil production was impossible under the French system of conscription. There are no reserved occupations outside armaments. The calling up of all classes when the country goes to war is based upon a theory of equality of sacrifice. This theory was put into practice as a matter of course before the country became so largely industrialised, but after the last war equality of sacrifice had to take into account the provision of everything necessary to carry on a future long and possibly exhausting conflict. The State nationalisation of armament production was undertaken by the Popular Front Government, which subordinated the idea of equality of sacrifice to the suppression of the capitalist hold on the manufacture and sale of war material. The armament departments of engineering firms were taken over with the machinery and plant and removed to State arsenals. The aircraft industry was merged into one State enterprise covering half a dozen national factories in different parts of the country. This State monopoly of armament production had the effect of ensuring a continuity of work when all other industrial activity was suspended by a general mobilisation. But in time of war the State had to make the fullest use of the country's engineering resources. There was a limit to the supply of skilled workers, which necessitated an organised distribution of labour as well as of raw materials. The Government therefore issued a list of manufacturers who were executing armament contracts, and they constitute a category of "armament works" which have priority over other makers in supplies. Machine tools and skilled hands were requisitioned outside this privileged category for transfer to other works engaged on armament contracts.

After the mobilisation, works and factories all over the country were rendered idle by the dislocation of civil activities. They were outside the range of the Commission of Armament Production which could only deal partly with a complex problem that must be treated as a whole. It was therefore decided to entrust a man of exceptional organising ability with practically unlimited authority to do what was necessary to put the country's entire engineering resources in a position to produce war material up to the limit of their capacity. Monsieur Raoul Dautry, a distinguished railway engineer and administrator, was made Minister of Armaments. The problem is, firstly, to render available for armament production all engineering resources, then to organise production for the civil population, and, finally, to recover and develop export trade. Obviously, all engineering potentialities cannot be employed effectively on armaments, or they can be more usefully employed in the national interest on civil production. Such manufacturers, therefore, depend upon an armament organisation that can release sufficient supplies of labour and raw materials. It was with the idea of completing details of plans laid down by the Minister of Armaments that a Permanent Advisory Committee was recently formed, comprising 35 members representing the Senate, Chamber of Deputies, and 12 Ministries, and 120 members representing various councils and committees associated with problems of national defence. The Armament Advisory Committee is divided into eight sections, each one dealing with a particular phase of the problem to be solved. It is, in fact, a sort of extra-parliamentary body with the Minister of Armaments at its head. The first section covers all matters relating to the utilisation of existing machinery and plants in big and small works for national defence and to the best methods of training, in as short a time as possible, useful workers for armament production, as well as of improving their social condition and social collaboration in works and factories. Other sections deal with the home iron and steel resources and the best means of utilising them by more complete methods of rationalising production and employing new processes and machines; supplies of non-ferrous metals within the French Empire; and the constitution of manufacturers' associations whereby all may profit from each other's experience and afford mutual assistance in the execution of contracts. The chemical, electrical, and other industries are dealt with by the remaining sections.

This Armament Advisory Committee concentrates the work of a number of State and semi-official councils and committees that, for the past two years, have endeavoured to organise industry on a new and more enduring basis. Conditions have changed with the awakening of interest in the social character of industry, which began under circumstances that precipitated an industrial collapse and is now being turned to account by employers who believe that the idea of collaboration between themselves and their workers can be put into some form that will ensure permanent in-

dustrial peace. When men are interested in their work the results are satisfactory to everyone concerned. While proving successful under particular conditions it has yet to be seen whether any general practical system can be evolved, and this problem will be kept in view by the committee. The more pressing need at the moment is the training of men to work in armament factories. Until about 10 years ago engineering industries employed a large percentage of foreign workers, who were repatriated when measures were taken to prevent a spread of unemployment, and from that time there has never been an excess supply of skilled hands. As the need for them increased a growing scarcity of skilled workers revealed a serious obstacle to further industrial development. Without such men the programme of industrial expansion becomes inoperative. There is ample material in France for producing excellent mechanics, but the apprenticeship system has never worked satisfactorily, except among big firms for their own special requirements, owing mainly to heavy obligations imposed on employers training apprentices, nor have private training schools always turned out young mechanics of the kind suitable to employers. The State compulsory apprenticeship organisation had not come into full operation when the war broke out, with a necessarily heavy demand for skilled workers. Existing machinery was put in hand for the instruction of specialised workers, and youths are given a two years' intensive apprenticeship training. The national importance of skilled workers is brought home to everyone. The Armament Advisory Committee will endeavour to settle upon an organisation that will satisfactorily meet the situation. This does not mean that armament production is suffering from a shortage of suitable workers. Nearly a million men are said to have been drafted from active service to work in armament factories. The rate of production is increasing, and it is because it cannot be foreseen how far it may be necessary to continue the progression that everything must be done to ensure an adequate supply of workers.

The war has brought into full play the scientific mind that pervades French plans for industrial and other development. Standardisation has made good progress during the past few years. It is now sought to simplify and facilitate production of war materials by reducing the number of standards and thereby creating what is called a "super normalisation." In 1930, the State decreed the constitution of a Comité Supérieur de Normalisation, the Association Française de Normalisation, and the Bureau de Normalisation, while a little more than a year ago it instituted the Commission Interministérielle de Contrôle des Travaux de Normalisation Industrielle. In 1936 the Centre National Scientifique de Travail was created by decree with the object of reducing production costs by combining normalisation with a scientific organisation of work. There is also the Comité National de l'Organisation Française, which arranged conferences on normalisation in December, at which the first meeting was presided over by the head of the department of National Economy. The State subsidises private associations, and standards proposed have to be submitted to the Comité Supérieur de Normalisation, which decides upon their expediency. The idea of spreading the work over a number of official, semi-official, and private bodies is to give a wide range to investigation and, eventually, to cover as great a part as possible of the national production. It also shows the high national importance attached to normalisation. It is regarded as essential to war economy when production must be raised to a maximum with national and colonial resources and with the most efficient use of labour. Normalisation is associated with a general plan to limit the number of types of similar machines manufactured in each works, constructed to standards or "norms" with materials that are themselves standardised, and with a scientific arrangement of work. The plan, of course, applies to all productions where normalisation can be practically introduced. Railway rolling stock is already completely standardised with a small number of types. During the past few years the work done by these committees and associations has been of a preparatory character, except in the case of armament manufacture, for which the new standards were adopted, and now that all engineering firms equipped for the work are engaged more or less on the production of war material they have become more familiar with the methods of normalisation and scientific work which aim at developing specifically French machines on the principle of quality and economy.

All the events and tendencies of the past year, crystallising as they do plans and ideas for giving a sound structure and more progressive opportunities to engineering industries, indicate another important change in the future. The first change occurred after the last war when the national importance of these industries was fully recognised. The end of that war left them with a greatly augmented capacity, which led to the introduction of new manufactures and a widening of the field of engineering enterprise. The development continued until ten years ago when, like all industries, mechanical engineering began to suffer vicissitudes which resulted in an amalgamation of firms, and a movement in favour of more economical and rational methods of production. This movement is characteristic of the new phase of economic progress which will have a notable influence upon engineering industries when the war comes to an end. Every effort is being made to organise civil production on these lines during the war and to prepare to meet difficult conditions that may arise immediately afterwards. Whether these plans will work out entirely as desired remains to be seen, but the organising forces are so strong, with the backing of the State and powerful industrial and economic groups, that some measure of achievement can hardly fail to effect a second transformation of the engineering industries as a whole. It will be seen that the character of this transformation is threefold. There is, firstly, to be an adequate supply of skilled labour by the State organisation of compulsory apprenticeship in which each employer must take an active part by training a number of youths representing a percentage of the total number of men and employees in the works. At the same time, there is a fuller comprehension of the changed attitude of workers which is, at present, kept from manifesting itself by war discipline, but after the war the alternatives are that the men must work in collaboration with employers or that the threat of an international labour union victory in a post-war reorganisation will again widen the breach between employers and men. Employers are actively supporting a social programme for bringing workers into close contact with themselves by means that will change their mentality of mere wage earners into that of collaborators with an individual sense of responsibility. A successful and promising start in this direction has already been made. Stable and efficient labour is essential to the carrying out of plans for organising engineering industries on a national basis. Secondly, the normalisation of industry on national lines, as foreshadowed, is expected to give it a character of efficiency and economy that will enable industry the more successfully to withstand vagaries of world fluctuations; and, thirdly, it will enable French engineering industries to play a larger part in foreign trade, whatever may be the conditions under which that trade will be organised after the war.

The history of French mechanical production explains complications that have caused so much trouble in giving cohesion to industry. Before the Revolution, France was an exclusively agricultural country with artisan trades, and the primary interests of agriculture have always been antagonistic to those of manufacturing industries. Engineering grew out of the artisan class in which skill, initiative, and invention were highly developed. The breaking up of the monopoly of trade guilds was followed by the spread of industry that produced men like Jacquard, whose loom transformed the textile industry in France, and Marc Séguin, the inventor of the tubular locomotive boiler, builder of suspension bridges, and a pioneer of French engineering. The Thomas-Gilchrist invention brought a great metallurgical industry to the country by the utilisation of the Briey phosphoric ores and placed engineering production on a sound foundation. The last war gave a rapid development to mechanical engineering industries which is now being accelerated in the direction of French manufactures that will find a readier outlet in international exchanges.

Sixty Years Ago

THE TAY BRIDGE DISASTER

REGARDED solely from the point of view of the number of lives lost—about eighty—the disaster to the Tay Bridge on the evening of Sunday, December 28th, 1879, was much less serious than some mishaps—such as the sinking of the "Princess Alice"—which preceded it, or than some—such as the Gretna railway crash—which have happened since. Yet in the history of calamities to man's handiwork it occupies a foremost place. In its stark tragedy, and in the apparent wantonness of its occurrence, it resembles the disaster to the "Titanic." To engineers it brought realisation of the fact that the bridges they had been building had been built in a large measure of ignorance concerning the forces which they would be called upon to bear. It was for that reason probably that the disaster exercised the deep effect which it did on the minds of those then alive and able to weigh its significance. Our first report of it—summarised in this note last week—seemed to make the facts of the occurrence fairly clear. The train from Edinburgh appeared to have reached the centre of the bridge when thirteen of the spans including the two which it was actually on at the moment collapsed. Soon, however, doubts began to arise, and mystery multiplied the effect of rumour. There were stories of a strange bright light on the bridge at the moment of the disaster and superstition became rife in certain circles. There was ample ground for the growth of doubt, mystery, and even superstition. The construction of the bridge had on at least two occasions been accompanied by fatalities, the death of one of the original contractors had led to a change of responsibility for its creation, unforeseen difficulties had been encountered in completing the bridge to the original design, alterations had again and again been made in its major and minor details, and novel expedients had been freely adopted for the execution of previously untried constructional features. Above all, in responsible technical circles serious doubt had, almost from the first, prevailed concerning the stability and strength of Bouch's design. The estuary of the Tay presented a funnel-like passage down which the winds could sweep at times with abnormal force. In a paper read before the Cleveland Institution of Engineers in November, 1876, Mr. Gilkes, one of the contractors, himself referred to "the often-advanced theory that at some period the bridge will be blown over" and gave figures intended to dissipate that belief. He took the exposed surface of one pier at 800 square feet, the surface of the girder portion supported by it also at 800 square feet, and the same figure again for the exposed surface of a train crossing the girder. According to his calculations it would take a wind pressure of 96 lb. per square foot acting on the aggregate of these areas to overturn the pier, whereas 21 lb. could be accepted as the greatest pressure exerted by a strong gale. In our issue of January 9th, 1879, we recalled these words of Mr. Gilkes, and remarked that wind pressures of 50 lb. per square foot had been recorded in this country. The Board of Trade had, we said, apparently passed as safe for public transport a structure with a factor of safety of only two. . . . Articles and correspondence on the disaster continued to appear in our columns throughout the year. As early as the issue named above, however, we had to publish a notice asking correspondents to refrain from overtaxing the space at our disposal. We had, we said, received many letters on the destruction of the bridge which we could not publish. One correspondent had suggested that similar bridges should, in the future, be made in such a way that when the wind blew too hard they could be reefed like the sails of a windmill. Another, we recorded, thought that they might be made to be capable, when required, of being turned over to present their edges to the wind.

BOOKS RECEIVED

First Steps in Machine Drawing and Design. By L. A. Johnson. London: Pitt's Popular Publications, 58, Telford Avenue, S.E.18. Price 1s. 6d. net.

Surveying for the Drawing Office. By L. C. Stanley, London: Draughtsman Publishing Company, Ltd., 96. St. George's Square, S.W.1. Price 3s. net.

British Railways To-day. By F. G. Fenlon, M.A., Ph.D. London: Thomas Nelson and Sons, Ltd., 35–36, Paternoster Row, E.C.4. Price 2s. 6d. net.

Timber: Its Properties, Pests, and Preservation. By F. Y. Henderson, D.Sc. London: Crosby Lockwood and Son, Ltd., Stationers Hall Court, E.C.4. Price 9s. 6d. net.

Oil-Engined Rail Traction in 1939

No. I

ALTHOUGH following a year in which record production of oil-engined vehicles took place, the year 1939 has seen much achievement, especially abroad. In spite of the outbreak of hostilities in many countries—the effects of which are hardly reflected yet in current production—the record of progress outlined in this article and those to follow shows that the ground already covered possesses sound foundations and is being well consolidated. By reason of the unsettled conditions prevailing in most lands it is difficult to foresee what the future will bring in the way of new types of vehicle, but certain well-marked trends have emerged, especially in those countries which can draw upon considerable experience.

It is particularly with shunting locomotives, of all powers, that oil-engine propulsion is gaining ground. Following upon recognition of the merits of hydraulic transmission, and the development of methods of control which are designed to improve the flexibility of such transmissions, the older designs of locomotive with purely mechanical transmission and friction clutches are steadily disappearing. In all countries this tendency is apparent, and the oil-engined shunter, with its high availability and low stand-by and low-load losses, would seem to be taking the place of steam locomotives in marshalling yards, large works, and other places where the duty is of an intermittent nature.

With the exception of practice in the United States, where high-powered single or double unit locomotives are used for hauling special lightweight passenger trains, passenger traffic is handled by trains of the multiple-unit-railcar type. A steady progress has been made in recent years in the development of multiple-unit control systems, and the experience gained in operating railcars coupled in large numbers in such train formations has led to their adoption as a standard by many railway systems.

As we have recorded in past years, the British railways have only played a small part in this progress. The British production of oil-engined locomotives and railcars, with one or two notable exceptions, and apart from relatively small shunting engines, has been destined for railways abroad. Various opinions are held to account for the slow growth of such traction on the British systems, mainly relying on the arguments that coal and suitable water supplies are plentiful in this country, that oil-engined locomotives and railcars have a high capital cost, and that sufficient experience in their use has yet to be gained to show that their wide application would be profitable. These views would seem to be contradicted by the experience of other countries, where oil-engined traction has been found to pay, not only because of its economy in operation, but also because of the fresh traffic it attracts.

In this connection the discussion last July at a meeting of the Permanent Commission of the International Railway Congress, held in Brussels, is of great interest. The importance of multiple-unit working was stressed. Such units are very suitable for meeting peak traffic conditions, as is shown by the experience of the Netherlands railways, on which three-car sets are coupled together up to a maximum of twelve vehicles. It has been stated in this country that it is difficult to meet peak loads by merely adding coaches, as is done with steam trains, but this view does not accord with the experience gained in the operation of multiple-control railcars, which can be coupled together and provide a train having the same performance whether composed of a large or small number of units. Valuable figures were given at this meeting of the cost of oil-engined train operation, the life of railcars, and their suitability for fast traffic, as well as their more obvious applications for branch line work and services with frequent stops.

In this and the articles which are to follow, we summarise the technical features of the production of oil-engined locomotives and railcars, describing firstly the products of British manufacturers, and then turning to the developments which have taken place abroad in the year 1939.

BRITISH PRODUCTION

Hydraulic Coupling and Engineering Company, Ltd.

As will be inferred from the descriptions of current railcar and locomotive productions in this article, fluid drive utilising Vulcan-Sinclair couplings is in wide use. Several improvements have recently been made in the construction of Vulcan-Sinclair products, notably in fitting what is termed an "idling drag eliminator" to the "Traction" coupling, and the evolution of a "Traction" gear-box with constant-mesh gears. These improvements in conjunction with the firm's "Tele-change" preselective control system enable, it is claimed, a light preselective control to be provided and the gears to be changed without complete interruption in the tractive

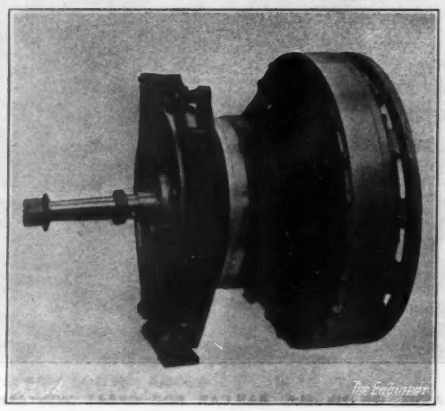


FIG. 1—FLUID COUPLING WITH IDLING DRAG ELIMINATOR

effort. The application of this system has been developed by Hudswell, Clarke, and Co., Ltd.—incidentally, the first firm of locomotive engineers to use the Vulcan-Sinclair fluid coupling—and "Traction" gear-boxes have been constructed to this maker's order by Bostock and Bramley, Ltd. Reference should be made to a description of shunting vehicles made by Hudswell, Clarke, and Co., Ltd., under another heading.

In Fig 1 is shown the latest form of fluid coupling and idling drag eliminator. The last-named mechanism, as its name implies, is designed to eliminate the drag inherent in the fluid coupling when the driving shaft is running at idling speed, so that dog-clutches within a constant-mesh gearbox can be easily engaged and disengaged. It comprises a brake drum connected through an epicyclic gear train to the output shaft, so arranged that the application of the band brake arrests the rotation of the drum and causes slow rotation of the output shaft backwards, thus making use of the idling torque of the engine to eliminate the drag of the fluid coupling. The brake drum is connected to a sun pinion meshing with planet wheels which are mounted on a carrier bolted to the coupling casing. The casing, of course, is driven directly by the engine. Another sun wheel slightly smaller in diameter is keyed to the output shaft of the coupling. Therefore, when the engine is idling, a torque is produced upon applying the brake, and this torque, acting through the gear train, has the effect of bringing the output shaft first to a standstill and then rotating it slowly backwards to facilitate gear engagement. If the locomotive is standing with the gear engaged, this backward rotation enables the drive to be readily disengaged, and another gear or the reverse drive, for example, to be engaged. To limit the braking

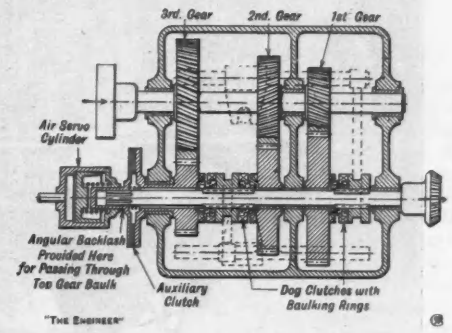


FIG. 2—CONSTANT MESH GEARBOX

force to a safe value a spring link is inserted in the brake-actuating linkage.

In connection with oil-engined railcar and locomotive operation, the Wilson epicycle gear-box is, of course, in wide use and makes an excellent combination with the fluid coupling. For shunting locomotives, requiring almost continuous gear-changing, a spur type of gear-box with dog clutch engagement is sometimes preferred, and the "Traction" gear-box, sponsored by the Hydraulic Coupling and Engineering Company, Ltd., is one example of such a simple layshaft gear-box, which incorporates an auxiliary clutch for maintaining some of the tractive effort during the change upwards from one gear to the next. In Figs. 2 and 3, reproduced from the *Railway Gazette*, are shown a section through a three-speed "Traction" gear-box and an arrangement diagram of the

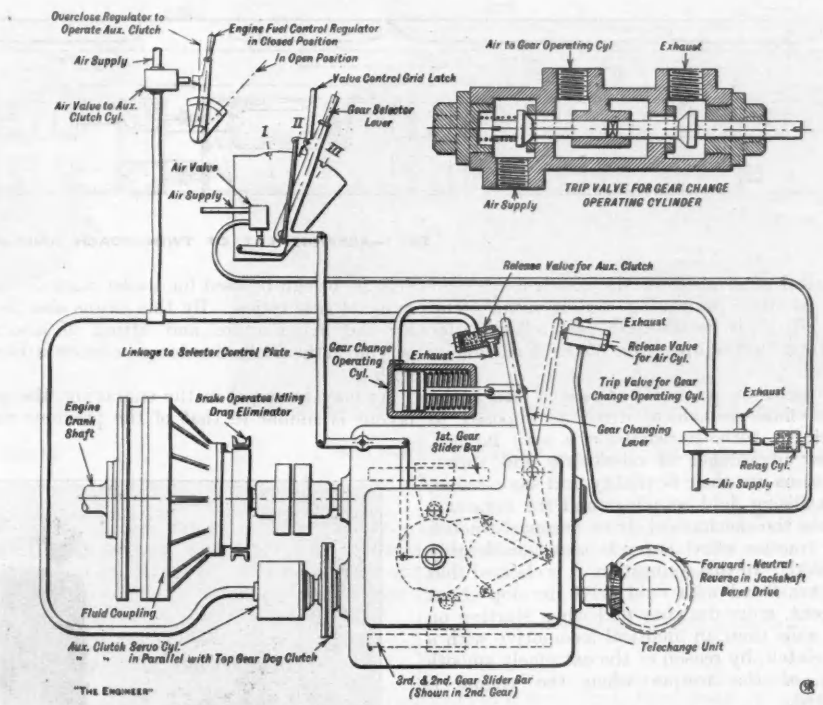


FIG. 3—COMPRESSED AIR CONTROLS FOR CONSTANT MESH GEARBOX

compressed air controls for its operation. The gear-box has constant-mesh gears and dog-clutches for their engagement, and is suitable for direct connection to a Vulcan-Sinclair coupling, fitted with the idling drag eliminator, there being no friction clutch in the main drive. For use when making upward gear changes there is provided an auxiliary friction clutch arranged in parallel with the top-gear dog-clutch. The purpose of the auxiliary clutch is to shorten the time required for changing gear "up" and to maintain traction on the vehicle while the ratio of the main drive is

being changed. Baulking rings are provided in the dog-clutch assemblies, to ensure that the gear change only takes place at synchronism, whether the change is being made up or down.

Since the dog-clutches are operated through spring-link or other resilient means, the control is made preselective. Changes of gear upwards are effected after selecting the gear required, by closing the throttle, which action admits air to engage the auxiliary clutch momentarily so that the gear change is rapidly effected, and the throttle is then reopened. Changes downwards are made by selecting the gear and momentarily closing and re-opening the throttle, the auxiliary clutch not coming into action. Pneumatic means are used for operating the gear change, the gear only being engaged on synchronism, by reason of the action of the baulking rings.

Considerations of space for the present article forbid a full description of the construction and working of this interesting arrangement. The drawing, Fig. 3, is for the most part self-explanatory, except for the operation of the Tele-change mechanism.

The improvements outlined above bring the claims of fluid-mechanical drive as opposed to oil-electric or turbo-transmission a step further. The chief advantages of oil-electric and turbo-transmissions are their flexibility and smoothness, but by utilising fluid couplings and the improved gear-boxes the mechanical drive becomes smooth and the tractive effort curve is also considerably smoothened. In this connection, it is claimed that locomotives fitted with fluid drive develop about 20 per cent. more drawbar pull when starting on slippery rails than an identical locomotive with a friction clutch, by reason of the extremely smooth build-up of the torque when the engine is accelerated.

The Associated Equipment Company, Ltd.

Production of railcars Nos. 19 to 38, forming an order for 20 cars for the Great Western Railway, was in progress at the works of the Associated Equipment Company, Ltd. These new vehicles are generally similar to the last of the 18 railcars previously delivered, which, we are informed, has given successful and reliable results in the working of the traffic for which it was designed. Following upon the experience gained in operating that unit, the cars forming the new order are modified in many respects and have several novel design features. A new control system has been evolved whereby multiple-unit working by means of electro-pneumatic gear, controlled from either end of a single car, a twin-car or a larger rake, is achieved. The connections between the cars are effected by means of a twenty-four cable jumper, no other connections apart from the vacuum pipe and a steam pipe being necessary.

An illustration of the chassis of one of the vehicles is reproduced in Fig. 4. By increasing the bogie wheelbase smoother running has been obtained, and at recent trials, at which we were present, the effect of this modification was noticeable. A novel feature of certain of the vehicles comprising this latest order is that in addition to the standard Wilson epicyclic gear-box, arranged to give five gear ratios, a dual ratio auxiliary gear-box is incorporated. In this way the vehicles can operate within the high range of gears when used for fast service solo or coupled with another power vehicle, or can be used for trailer work on the low range of gear ratios. By this means also the need for the manufacture and fitting of alternative gearing in the final reduction gear-boxes is dispensed with.

As may be noted in the engraving, the general layout is similar to that of the previous vehicles made by this firm. Twin engines, each having six cylinders and an output of 105 B.H.P. at 1650 r.p.m., are arranged one on each side, each driving the two axles of a separate bogie, the two axles of each bogie being coupled through transmission shafts and universal joints. Reversing gears are incorporated in the axle boxes. The control gear is particularly neatly laid out and effective in operation. A further modification is in the arrangement of the engine cooling system and radiator, which has been redesigned so as to occupy a smaller space, to be readily accessible, and to produce efficient cooling independently of the direction of motion of the vehicle.

In a forthcoming article we hope to give a full description of this interesting new series of railcars, which still holds its place as the only series ordered in quantities for use on the British main line systems. A drawing of one of the twin-car units is shown in Fig. 5. The Associated Equipment Company is responsible for the design of the cars, the manufacture of the engines and the mechanical parts, and supplying and fitting the power and transmission units, but the construction of the bogies, underframes, bodies, and the fitting of automatic train control apparatus is being carried

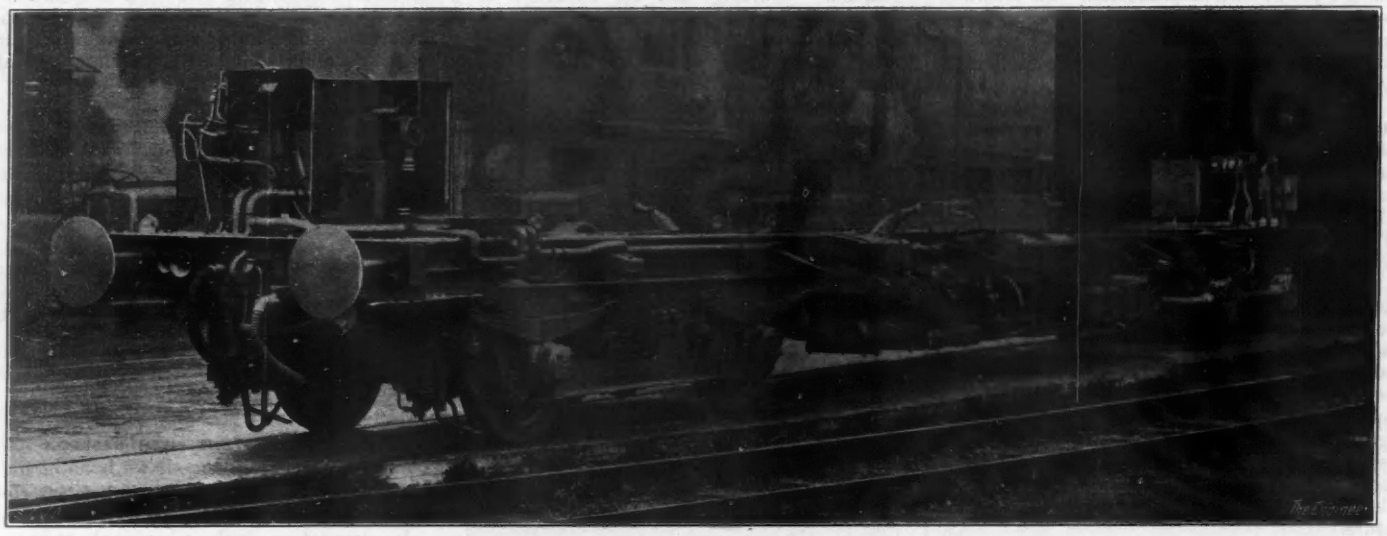


FIG. 4—CHASSIS OF 210 H.P. RAILCAR FOR GREAT WESTERN RAILWAY

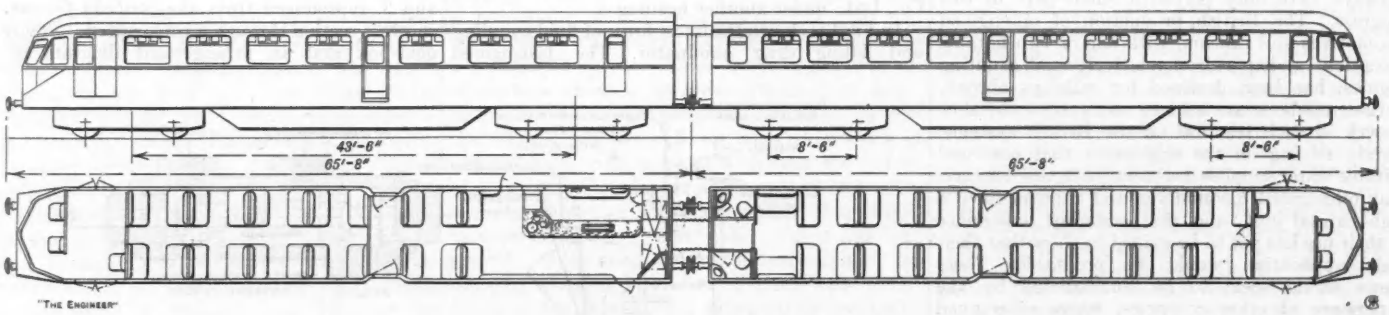


FIG. 5—ARRANGEMENT OF TWIN-COACH RAILCAR UNIT

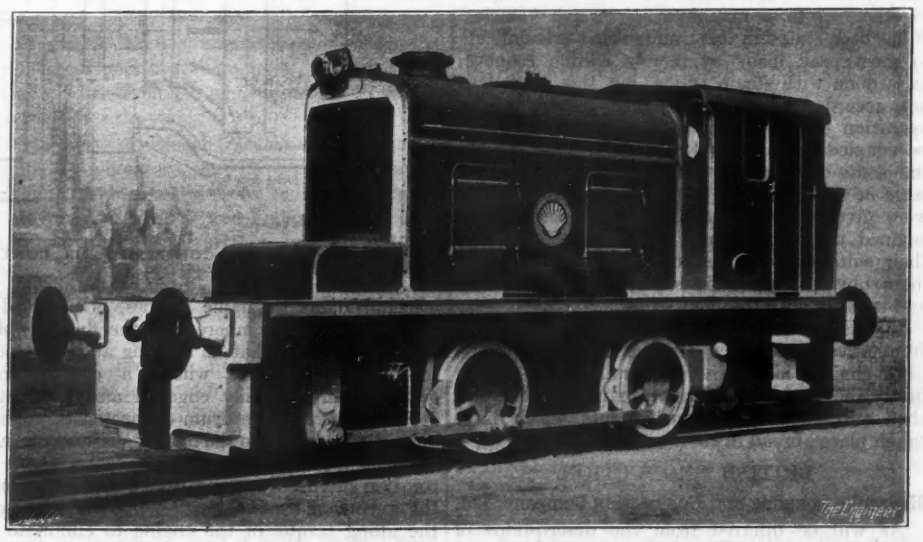


FIG. 6—30-TON 204 B.H.P. SHUNTING LOCOMOTIVE

out in the Great Western Railway's works at Swindon.

Hudswell, Clarke, and Company, Ltd.

Special locomotives have been developed by this firm for some time past for operation in oil refineries, designed to prevent spark emission at any point. In Fig. 6 is shown a new 30-ton 0–4–0 locomotive of this type, recently completed by Hudswell, Clarke, and Co., Ltd., for the Shell-Mex group of companies. The equipment for eliminating the fire risk is very complete. It includes the provision of a water tank with a capacity of 300 gallons for spraying the rails if the wheels should slip, and thereby preventing sparks from that source, and the covering of the buffer heads.

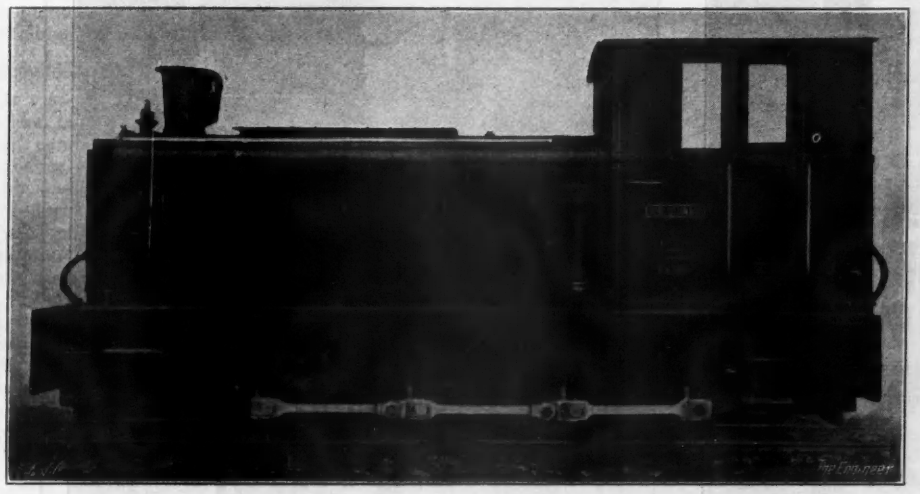


FIG. 7—180 B.H.P. LOCOMOTIVE FOR SOUTH AFRICA

The locomotive is fitted with a Gardner 8L3 oil engine, giving a maximum output of 204 B.H.P. at 1200 r.p.m. This type of engine has eight cylinders, with bores of 5½in. and stroke 7¾in., and follows standard Gardner practice, that is to say, it has direct injection with C.A.V.-Bosch pumps and Gardner injection nozzles, cast iron cylinder blocks in pairs, and the crankcase in two parts with the lower part carrying the bearings.

The transmission is mechanical through a Vulcan-Sinclair fluid coupling and a "Traction" gearbox to a jackshaft. Preselective control is arranged in accordance with the "Tele-change" control system. This type of transmission, applied previously to a number of shunting locomotives by the firm, has been evolved by the Hydraulic Coupling and Engineering Company, Ltd., and is described in a previous part of this article. As mentioned in that part, a feature of the system is that only slight loss of torque takes place during gear changes in an upward direction and consequently on up grades the speed is only slackened slightly while a change of ratio is effected. The transmission on this partciular locomotive is arranged to give speeds of 3, 5, and 9 m.p.h. at maximum engine revolutions.

Vulcan Foundry, Ltd.

At the works of the Vulcan Foundry, Ltd., there were in course of construction ten oil-engined railcars with mechanical drive for the New Zealand Government Railways. These vehicles are to run on 3ft. 6in. gauge track and are of the double bogie type, with the drive on one bogie. On the power bogie are mounted a "Vulcan-Frichs" six-cylinder oil engine, provided with a hydraulic coupling, a five-speed gear-box, and cardan shafts driving to final reductions in the form of spiral bevel gears fitted to the two axles of this bogie. The engine is designed to develop a normal output of 250 B.H.P. and a maximum of 275 B.H.P. and the gears are arranged to give a maximum speed of 75 m.p.h. At each end of each car a driving compartment is arranged with controls for multiple unit operation of two cars. Accommodation for 52 seated passengers is provided and the entrance doors are operated by power.

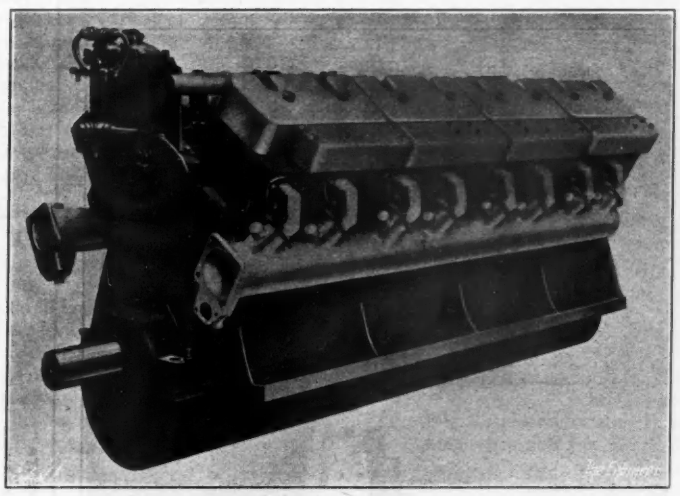


FIG. 8—SIXTEEN-CYLINDER 900 B.H.P. VEE OIL ENGINE

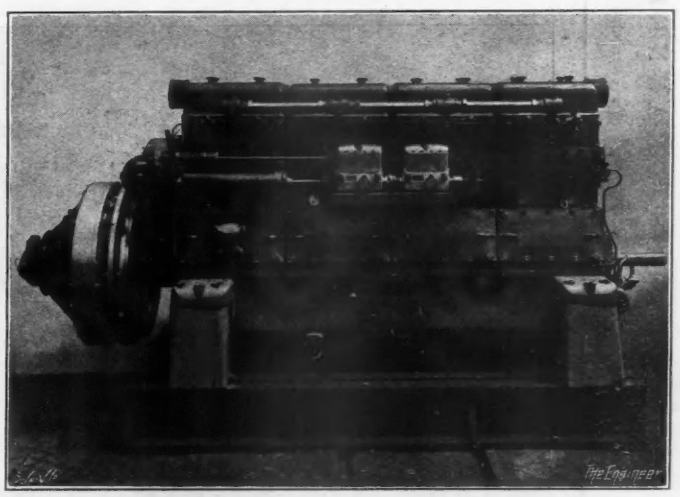


FIG. 9—EIGHT-CYLINDER 244 B.H.P. OIL ENGINE

Andrew Barclay, Sons, and Co., Ltd.

Several oil-engined locomotives of about 150 H.P. were supplied to Government departments by this firm. All of them are fitted with fluid couplings and Wilson three or four-speed epicylic gear boxes. Of other locomotives built, one of the most interesting is illustrated in Fig. 7. It is of the 0–6–0 type and is constructed for service in South Africa on 3ft. 6in. gauge lines, to the order of Imperial Chemical Industries, Ltd. Power is supplied by a Paxman-Ricardo eight-cylinder oil engine with an output of 180 B.H.P., and the transmission is through a fluid coupling, a Wilson three-speed gear-box, and a reverse and final drive unit of Bostock and Bramley manufacture. Intended for shunting work, the locomotive is geared to give speeds of 4, 7·6, and 12 m.p.h. at full engine speed. Westinghouse air brakes are fitted, the air being supplied by three compressors, one of which is a standby. Compressed air supplied by a belt-driven compressor is also used for starting the engine. An independent oil-engined compressor set is provided in the cab for emergency use. Since the locomotive is intended for use in danger areas, flameproof equipment is fitted. Both engines are furnished with Alexander's Vortex silencers, that on the main engine being of the spray type, and the electric lighting system is also flameproof. The total weight of the locomotive in working order is 27 tons.

Another similar locomotive was supplied to Imperial Chemical Industries, Ltd., for 4ft. 8½in. gauge for use in this country.

Davey, Paxman, and Co. (Colchester), Ltd.

Several types of oil engine suitable for rail traction purposes are made by this firm. In particular the "Vee RB," a photograph of which is reproduced in Fig. 8, has been developed for high power outputs combined with low weight and space requirements and is therefore especially useful for high-speed railcar applications. By reason of its high power to weight ratio it can be made to produce rapid acceleration, and smooth running and flexibility is attained by the arrangement of a large number of cylinders in vee formation. The engine illustrated has sixteen cylinders and a traction rating of 900 B.H.P. at 1500 r.p.m. The bore and stroke are 7in. and 7½in. respectively. Eight and twelve cylinder engines of this type are also manufactured. As with the other types of oil engine for rail traction made by this firm, the combustion chambers are of the Ricardo "Comet" pattern.

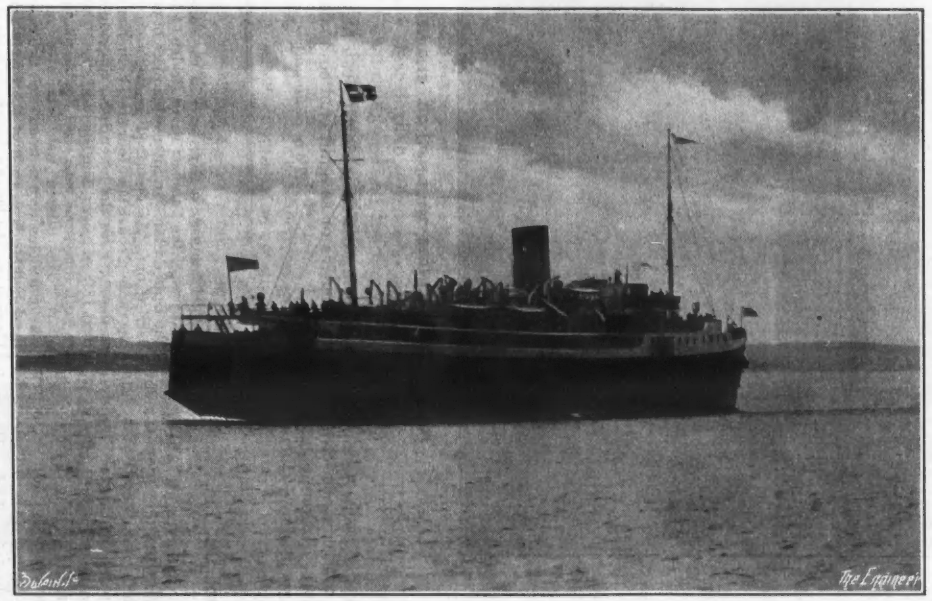
Another engine built in large numbers for rail traction is the "RWT" series, having a bore of 5½in., and a stroke of 7in., and constructed with four, six, or eight cylinders. In Fig. 9 an eight-cylinder engine of this type, fitted with a Vulcan-Sinclair fluid coupling, is shown. It is designed to run at speeds up to 1500 r.p.m. and to have an output of 244 B.H.P. as a traction rating. The engine illustrated is arranged for electric starting, but compressed air starting can be supplied as an alternative or as additional equipment.

(To be continued)

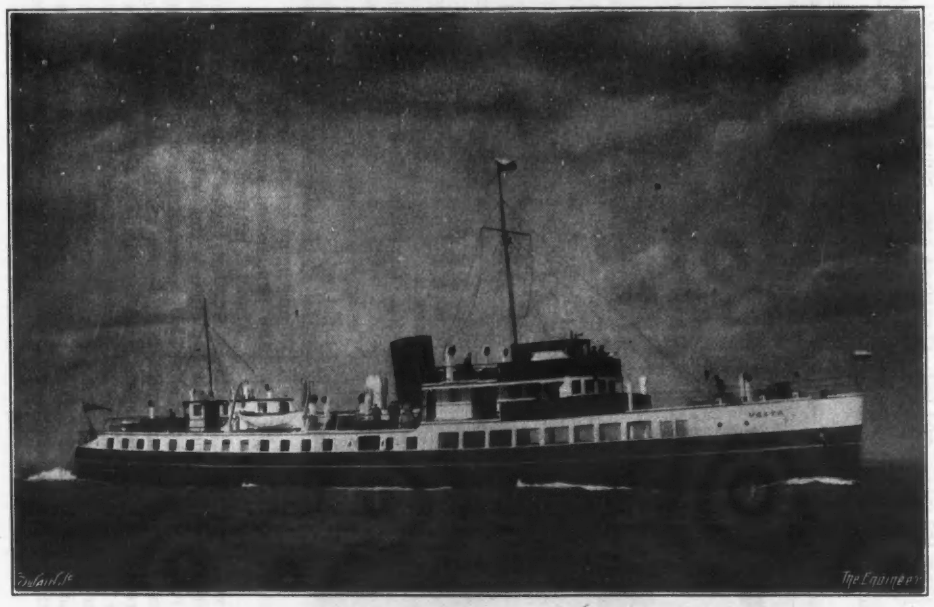
AN INTERESTING CAISSON. In the construction of the first pier of the Potomac River Bridge at Ludlow Ferry in the United States an interesting piece of caisson work was carried out. As described in *Engineering News Record*, the caisson consists of four steel cylinders 60ft. high, 32ft. in diameter for the lower 10ft., tapering to 11½ft. in the next 18ft. of height, and then to 10ft. at the top, connected in both directions with steel double diaphragm walls 4ft. apart. The caisson was fabricated on a submerged platform alongside a railroad dock two miles from the site. Steel bulkheads in each of the four cylinders permitted blowing out the lower sections (open at the bottom) with compressed air to float the whole assembly. When afloat, the caisson was towed to the pier site where it was sunk. The caisson landed on a previously prepared timber platform, 56ft. below water level and supported on wood piles. Through openings in the platform, 152 steel H piles from 120 to 157ft. long had been driven in four clusters. Each cluster of piles projected as much as 17ft. above the platform, and left little clearance inside the cylinders.

CROSS-CHANNEL SHIPS OF 1939

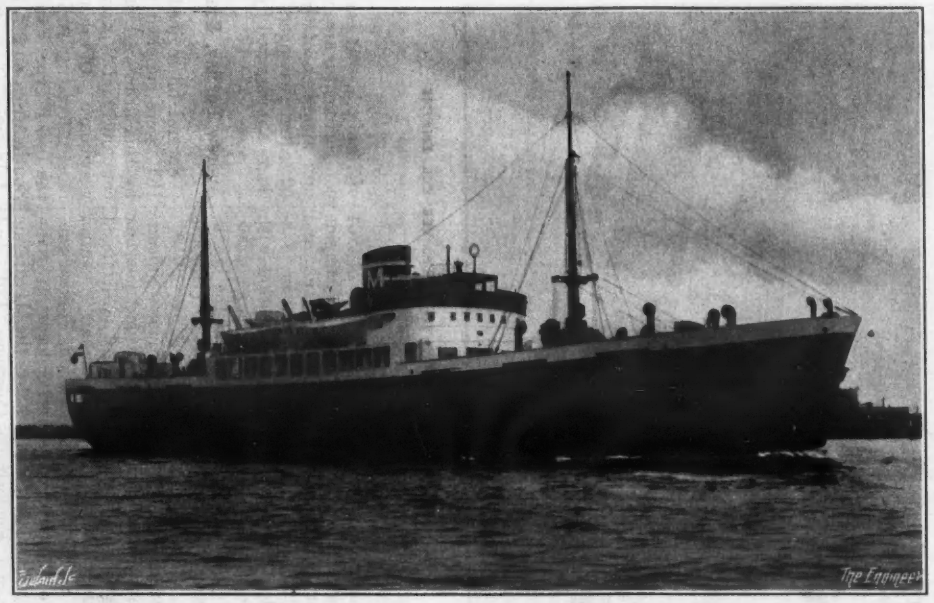
(For description see opposite page)



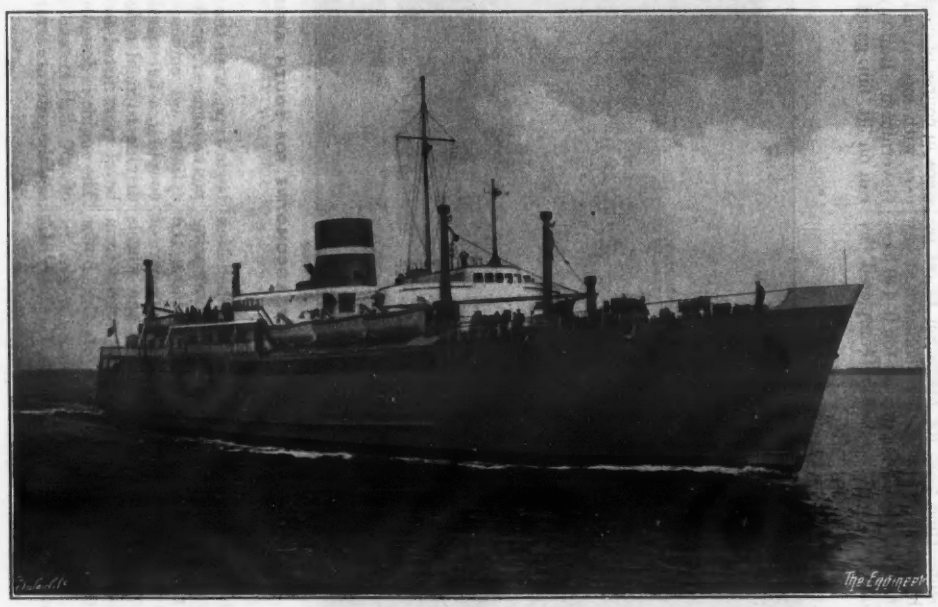
M.V. "VECTA"



M.V. "PRINCESS VICTORIA"



S.S. "BATAVIER III"



M.V. "KONINGIN EMMA"

Shipbuilding and Marine Engineering in 1939

No. II

(*Continued from page 21, Jan. 5th*)

WE continue in this article our description of the work of the shipbuilding industry, both at home and abroad during last year, giving some account of the more interesting ships which were completed and launched.

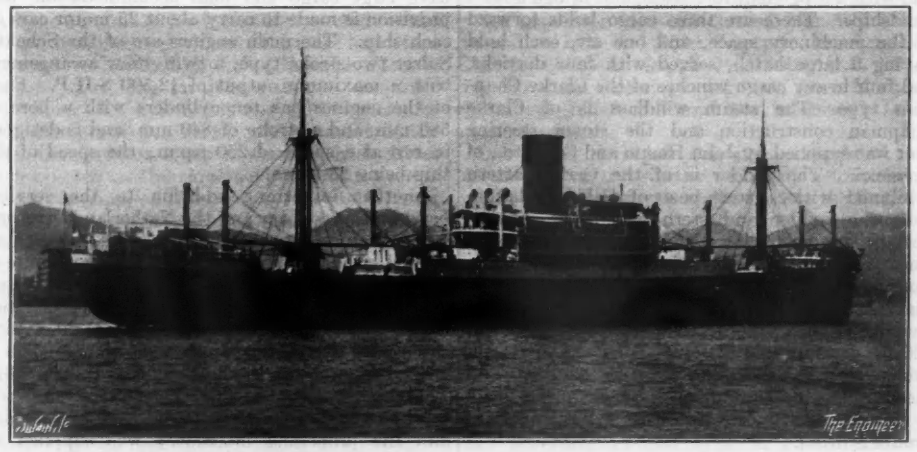
Shipbuilding Returns

In view of the international position, many firms decided not to give particulars of the ships which were completed during the year under review. Probably one of the largest outputs of British yards was that of Harland and Wolff, Ltd. That firm during 1939 completed over 120,000 gross tons of merchant shipping. Although no detailed analysis of this important contribution to the Empire's Merchant marine can be given, it may be stated that of this output no less than 52,000 gross tons consisted of Empire food ships, having a total refrigerated capacity of over two and a half million cubic feet. The remainder of the output was made up of passenger liners, tankers, coasting vessels, and other small craft. These ranged from passenger and mail liners of the largest sizes, both turbine and motor ships, to a small steam-driven coaster which was completed for a distant Dominion. As in previous years the company's engineering shops were busily engaged on the construction of marine oil engines, of the Harland-B. and W. type, and engines of this kind totalling approximately 100,000 I.H.P. were installed in merchant ships. Geared steam turbine installations also occupied a prominent position during the year under review, and machinery of this type totalling almost 120,000 S.H.P. was completed for naval and mercantile ships. The Harland and Wolff ship repairing establishments at Belfast, Glasgow, London, Liverpool, and Southampton carried out during the year a wide diversity of repairs to over 2000 vessels. They included not only voyage and running repairs, but in many instances works of major reconstruction. No particulars can be given of the volume of work in hand, which covers ships of wide diversity, but it can be stated that the various establishments of the company are playing a very important part in the nation's productive effort, and that the unrivalled facilities which these works offer are being utilised to the full.

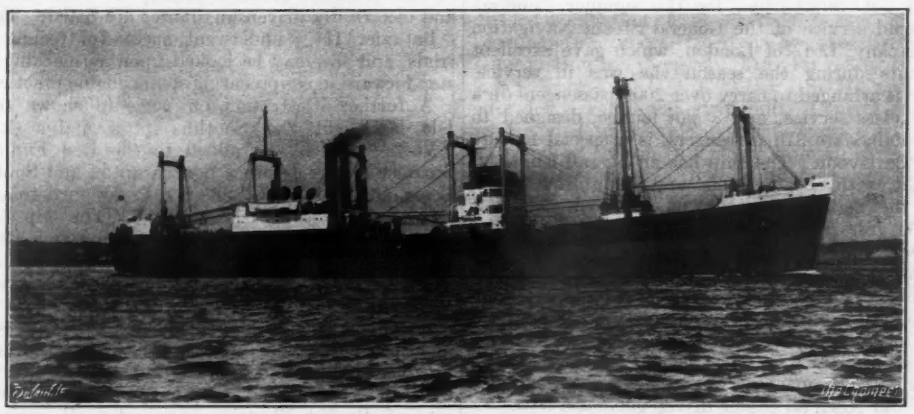
Outstanding Ships of 1939

A good example of the modern British cargo liner is provided by the "Breconshire," which is one of four cargo liners added to the fleet of the Glen Line, Ltd. Two of the ships which entered the service of the company during 1939 were the "Glenearn" and "Glenroy" to which reference was made in last year's article—see issue of January 13th—and these two vessels were followed by the "Denbighshire" and "Breconshire." The latter ship was built by the Taikoo Dockyard and Engineering Company of Hong Kong, Ltd., managed by John Swire and Sons, Ltd., of Billiter Square, London, E.C.3 and is the first of two motor ships ordered for the Glen Line, Ltd., through Alfred Holt and Co., Ltd., of Liverpool. The overall length is 506ft., with a moulded beam of 66ft. and a depth moulded of 38ft. The ship has three complete steel decks, with poop longbridge, and forecastle erections. A double bottom is fitted all fore and aft for the carriage of oil fuel or water ballast. There are six cargo holds, one of which is insulated for the carriage of frozen goods. Special attention has been given to the design and construction of the cargo handling gear, and twenty-eight electric winches are fitted, which with the steel derricks are designed to operate lifts up to 50 tons. Both the windlass and the steering gear are electrically operated.

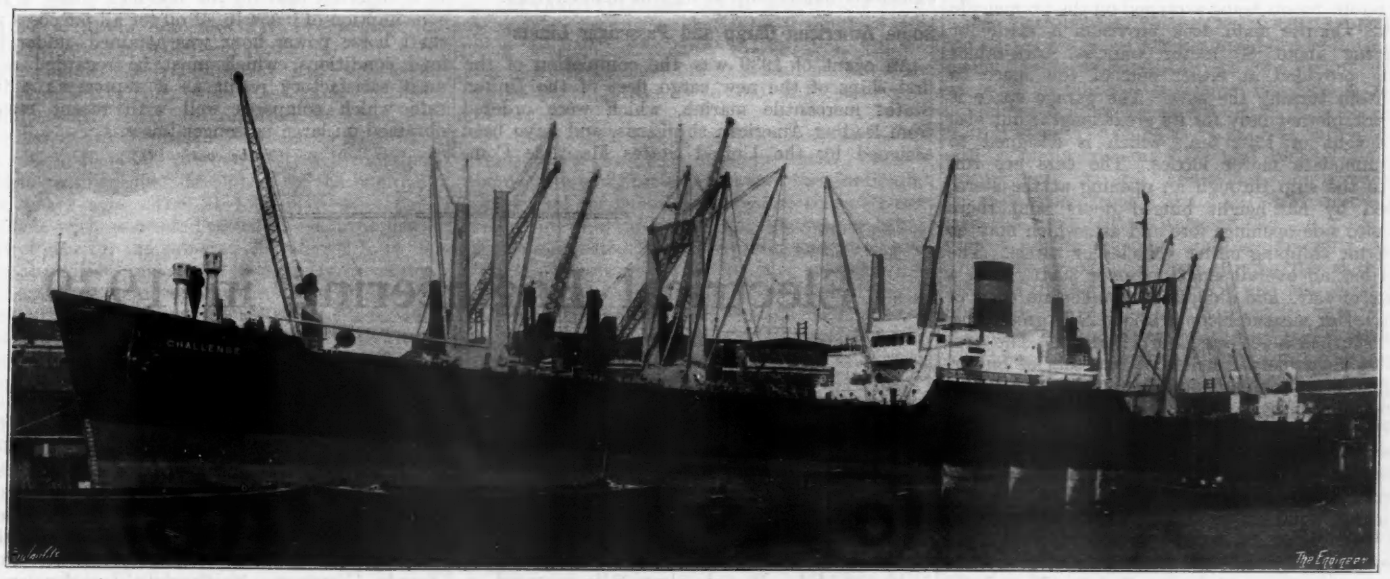
Accommodation is provided for 12 first-class passengers, and is conveniently and comfortably arranged on the promenade deck, the officers and engineers being housed in accommodation amidships, and the crew berthed in the poop. The propelling machinery consists of a twin-screw installation of Burmeister and Wain six-cylinder, two-stroke, double-acting oil engines, each having a designed service output of 6000 S.H.P. Special attention was given to the balancing of the engines in order to ensure complete freedom from vibration throughout the entire working range. The auxilary machinery to which some reference has already been made is electrically driven, and the current for power and lighting is furnished by four oil engine driven generating sets, each having a designed output of 300 kW at 220 volts D.C. The steamer "Barwon," which was built by the Caledon



GLEN LINE MOTOR SHIP "BRECONSHIRE"



AUSTRALIAN STEAMSHIP "BARWON"



AMERICAN STEAMSHIP "CHALLENGE"

Shipbuilding and Engineering Company, Ltd., of Dundee for the Australian service of Huddart Parker, Ltd., of Melbourne, forms another type of ship for economical cargo service. She has a length between perpendiculars of 360ft. with a beam of 50ft. and a depth moulded of 27ft. 3in. to the upper deck. The deadweight carrying capacity is 5500 tons on a moderate draught. The hull and machinery of the "Barwon" were constructed to Lloyds highest class under special survey, and in addition the crew spaces, lifeboat, and life-saving equipment conform to the latest Board of Trade requirements and to the provisions of the Australian Commonwealth Navigation Act. The ship is of the single deck type, with a long raised poop covering the machinery space and with a topgallant forecastle, and bridge houses amidships. There are three cargo holds forward of the machinery space, and one aft, each hold having a large hatch, served with four derricks, and four heavy cargo winches of the Clarke Chapman type. The steam windlass is of Clarke Chapman construction and the steam steering gear was supplied by John Hastie and Co., Ltd., of Greenock. The rudder is of the Oertz pattern combined with a stern-post of Caledon design, both the rudder and stern-post being streamlined. The propelling machinery consists of a single screw Kincaid triple-expansion engine working in conjunction with a Bauer-Wach exhaust turbine. Large capacity Scotch boilers with North-Eastern superheaters supply steam at 220 lb. pressure and 620 deg. Fah. Allen steam-driven electric generating plant is installed, and the refrigerating equipment is by Frigidaire, Ltd. A Stone propeller of "Heliston" design made in bronze is fitted.

Some Cross-Channel Ships

During the past year some notable cross-channel steamers and motor vessels went into service and others were launched. In our issue of May 26th we described and illustrated, the twin-screw motor vessel, "Royal Daffodil," which was constructed by William Denny and Brothers, Ltd., of Dumbarton, for the summer London–Ostend service of the General Steam Navigation Company, Ltd., of London, which gave excellent results during the season she was in service. She is arranged to carry over 2000 passengers on a one class service, and a sun lounge, designed to accommodate 370 passengers, is a special feature of the layout. The ship has an overall length of 313ft., with a beam of 50ft., and a depth of 12ft. 6in. to the main deck. Her measurement is about 2060 gross tons, and she has a designed service speed of 19 knots. The propelling machinery consists of a twin-screw arrangement of Sulzer twelve-cylinder oil engines, having a bore of 360 mm., a stroke of 660 mm., each engine having an output of 2250 S.H.P. at a normal running speed of 320 r.p.m. The current for the deck and engine room machinery, and lighting, is supplied by four Allen oil engine driven generator sets.

Another interesting ship which was also completed by the same builders was the "Princess Victoria" (see page 46), built for the Larne-Stranraer service of the London, Midland and Scottish Railway Company. This new motor ship went into service early in July last. She is designed to carry a total of 1500 passengers, in first and third-class accommodation, most of the public rooms being arranged on the promenade deck. On the main deck provision is made for carrying about 80 motor vehicles, turn-tables being provided at either end of the space to facilitate turning the cars. The garage space is remarkable not only for its great length, but also its height of 12ft. 6in., which is designed to accommodate motor lorries. The cars are run on to the ship through an opening at the stern, closed by half-height hinged doors, and there are also side openings fore and aft, which may be used for shipping either vehicles or cattle. The ship has an overall length of over 300ft., with a beam of 48ft., and a depth to promenade deck of 29ft. Her measurement is about 2197 gross tons, and she has a sea speed of 19 knots. The propelling machinery consists of two sets of Sulzer, trunk-piston engines, working on the two-stroke principle, giving a total output of about 5000 S.H.P. when running at 265 r.p.m. The electrically operated car ramps which were designed to operate with the "Princess Victoria" are of particular interest, and the ramp at Larne was described in an article published in our issue of November 24th. It was constructed and erected by Spencer (Melksham), Ltd., of Melksham, Wilts. The ramp at Stranraer was supplied by P. and W. MacLellan, Ltd., of Glasgow.

Two other larger cross-channel ships of the year were the ships "Koningin Emma" and the "Princess Beatrix" which were placed during the year on the passenger and mail service of the Zeeland Steamship Company of Flushing, between Harwich and Flushing. The "Koningin Emma" is illustrated on page 46. These two motor vessels were built and engined at the Flushing yard of the Royal de Schelde Company, and their principal dimensions and particulars are as follows. Length overall 380ft., beam moulded 47ft., depth to upper strength deck 28ft., maximum draught 13ft 6½in., and measurement 4135 gross tons. Provision is made to carry a maximum of 1800 first- and second-class passengers, and very comfortable and modern equipment has been provided. The ships have large cargo and mail accommodation, and provision is made to carry about 25 motor cars on each ship. The main engines are of the Schelde-Sulzer two-stroke type, a twin-screw arrangement with a maximum output of 12,500 S.H.P. Each of the engines has ten cylinders with a bore of 580 mm. and a stroke of 840 mm. and is designed to run at a speed of 250 r.p.m., the speed of the ship being 23 knots.

Another important addition to the services between this country and the Netherlands was provided in June by the "Batavier III," which then started sailing on the London–Rotterdam route of W. H. Muller and Co. (London), Ltd. She is illustrated on page 46. A shelter deck steamer, designed to carry three classes of passengers on night service, she has an overall length of 283ft. 6in., a beam of 43ft. 7in., and a depth moulded of 23ft. 10in. The gross tonnage is 2687 tons. The ship was built at the De Noord shipyard at Alblasserdam, and the propelling machinery was supplied by Werkspoor of Amsterdam. It consists of a single-screw arrangement with a 3000 I.H.P. Werkspoor engine with Meier-Mattern valve gear, taking steam at a working pressure of 250 lb., and a final superheated temperature of 617 deg. Fah. from two Scotch boilers each with a heating surface of about 3670 square feet. The boilers are oil fired on the Wallsend-Howden principle. Both steam and electrically driven auxiliaries are fitted. The "Batavier III" underwent successful technical trials, and she may be looked upon as marking a step forward in reciprocating steam engine practice.

A further illustration on page 46 shows the Isle of Wight and Southhampton motor ship "Vecta" which was added to the Red Funnel Steamer service between Southampton and South Coast ports in April. She is also designed to act as a tender to large Atlantic liners. The ship was described and illustrated in our issue of March 31st. She was built by John I. Thornycroft, Ltd., at Woolston Yard, Southampton, and is of interest as being one of the British ships of the year to employ Voith-Schneider propulsion. The "Vecta" has an overall length of 199ft. 6in., with a moulded breadth of 30ft., and breadth on the water line of 27ft. The propelling machinery comprises two sets of English-Electric six-cylinder oil engines having a bore of 15in., a stroke of 20in., and a designed output of 1300 S.H.P. total. The propellers have a blade orbit of 1800 mm., and are six bladed, the length of each blade being 1200 mm. The electric generating plant was supplied by Ruston Hornsby, Ltd., and the English Electric Company, Ltd. The bridge controls make an extremely handy ship as regards manœuvring.

Some American Cargo and Passenger Liners

An event of 1939 was the completion of the first ships of the new cargo fleet of the United States mercantile marine, which were ordered from leading American shipyards, and have been assigned by the United States Maritime Commission to American shipping companies. During the month of August, visits were paid to this country by two ships, the "Donald McKay," belonging to the Moore-McCormack Lines, and the "Challenge," which has been assigned to the American Hampton Roads Line. The ships belong to the first series of C.2 cargo liners, for which standard building specifications were prepared by the United States Maritime Commission. Each of the ships has the following dimensions, and the general arrangement of the hull, cargo holds, and deck machinery is the same, the only difference being the steam or oil engine propelling machinery. The C.2 liners have an overall length of 459ft. and a length of 435ft. between perpendiculars. The extreme beam is 63ft., the moulded depth 40ft. 6in., and the draught to summer marks 25ft. 10½in. The designed normal speed on the loaded draught under average sea conditions is 15½ knots. The measurement is about 6194 gross tons, the deadweight carrying capacity about 7500 tons, and the total displacement at the loaded draught about 13,500 tons. As will be seen from the illustration on page 47, the ships have a raked stem and a cruiser shaped stern. The two complete steel decks extend from bow to stern, and a third steel deck is carried from the stern to the forward bulkhead of the engine room and from the after bulkhead of the engine room to the aft end of the No. 4 hold. The double bottom extends from the forward collision bulkhead to the forward end of the shaft tunnel recess. In the No. 2 and No. 4 holds there are special deep tanks, which can be employed for carrying dry or liquid cargoes, or in conjunction with the double bottom tanks for ballasting the ship. There are five cargo holds, three forward of the machinery space and two aft, and as will be seen from our illustration, derricks and Samson posts are provided, and geared electrically driven cargo winches provide excellent cargo handling facilities. Apart from the provision for the officers, engineers, and crew, which is of a very high order, there is accommodation for twelve passengers on the bridge deck, with six large state rooms adjoining a lounge and large dining saloon.

In the "Donald McKay," which was built and engined by the Sun Shipbuilding and Dry Dock Company, of Chester, Pa., the main engine is a four-cylinder Sun-Doxford opposed-piston engine, having cylinders with a bore of 32in. and a combined stroke of 92in. The designed output is 6000 S.H.P. at 92 r.p.m., provision being made for an overload of 10 per cent. continuously, or an overload of 25 per cent. for a period of two hours. The requirements of the auxiliary machinery load, power, and lighting, are met by three 250 kW oil engine driven generator sets of the Cooper-Bessemer type; a waste heat boiler of the Foster-Wheeler type is fitted.

The turbine-driven steamer "Challenge," which visited the West India Dock on Thursday, August 3rd, and was the subject of an article which appeared in our issue of August 11th, was built by the Federal Shipbuilding and Dry Dock Company of Kearney, New York, and the machinery was supplied by the General Electric Company. It consists of a set of cross-compound double-reduction geared turbines, taking steam from two Foster-Wheeler "D" pattern oil-fired boilers. A full description of the machinery with illustrations will be found in the article just mentioned. It is reported that on the builder's trials, a fuel consumption of 0·554 lb. of oil for all purposes per shaft horse power hour was attained, under full load conditions, which must be regarded as a most satisfactory result as it represents a fuel rate which compares well with recent results obtained on large passenger liners.

(To be continued)

Electrical Engineering in 1939

No. II

(Continued from page 10, Jan. 5th)

Transformers

TRANSFORMER orders were received by Bruce Peebles and Co., Ltd. from all parts of the Home Country, from Canada, New Zealand, South Africa, India, and other parts of the world. Two 30,000 kVA, 132kV grid transformers are of the O.N./O.F.B. outdoor type. The O.N. rating is 19,000 kVA. Remote electrically operated on-load tap changing gear is provided on the E.H.T. side. The radiators are separately mounted, and are complete with fans and oil circulating pumps.

Other contracts included five 20,000 kVA, 33,000/11,000–6600 volt outdoor transformers of special construction for the Central Electricity Board; eighty transformers in various sizes aggregating 31,000 kVA for a Scottish Electricity Supply Company; thirty-eight transformers in various sizes totalling 33,500 kVA for a Scottish

Public Supply Authority. One hundred and forty transformers in different sizes totalling 27,000 kVA are for a power supply in England; a 3000 kVA 121 kV/4·6 kV single phase, and six 1500 kVA 26 kV/4 kV, 3-phase transformers for a Canadian Power Company, and three 6000 kVA, 21 kV/6·6 kV, 3-phase transformers for a New Zealand Power Board. Many orders were received for transformers for industrial electrification.

Rectifiers and Motor Converters

Although the water cooled steel tank rectifier continues to be preferred for 3000 volts D.C. and upwards, at the lower voltages there is now competition between three established types, viz., steel tank water-cooled rectifiers with pumps, steel tank air-cooled units and glass bulb rectifiers. The British Thomson-Houston Company, Ltd., claims to be the only firm making all these types, the steel tank pumpless rectifier, illustrated herewith, having been developed during 1939. Five of these equipments with the associated A.C. and D.C. switchgear have been built to augment the supply to an electric railway in the London district. Each equipment is rated at 1500 kW, 630 volts, and consists of four pumpless rectifiers operating in parallel with a six phase input. The rectifiers will be installed in two existing sub-stations, where they will replace motor converters.

Another order covers four pumpless rectifier equipments each rated at 2000 kW, 630 volts, together with all the associated A.C. and D.C. switchgear for installation in a new sub-station on the London underground system. Each equipment will consist of four rectifiers in parallel and will operate twelve phase. It is claimed that this installation will form the largest pumpless rectifier sub-station in existence. Many detail improvements have been made in B.T.H. water cooled rectifiers with pumps, in the directions of increasing the ratings obtainable and of improving the reliability of the pumps and auxiliaries.

An important contract now in hand covers twelve 1500 kW, 630 volt, 12 phase rectifiers with all auxiliaries and associated switchgear. These rectifiers will be installed in five sub-stations of the Central London line. They will be controlled from a common control room by supervisory gear employing a single pair of wires for controls and indications.

The British Thomson-Houston Company, Ltd., claims to have secured practically all the orders placed in Great Britain for rectifiers working at the higher D.C. voltages and with the more elaborate kinds of grid control. For the New South Wales Government railways two 1500 kW, 1530 volt rectifier equipments with grid control for over-compounding and arc suppression are now being installed in a new sub-station at Caringbah. In South Africa, two additional 1500 kW rectifiers and one 2500 kW rectifier for 3000 volts D.C. are being supplied to augment the supply on the Johannesburg suburban system which was electrified about three years ago, mainly with B.T.H. rectifiers. Like the original rectifiers, the new units are arranged for arc suppression by grid control in the event of backfire or short circuit, with automatic resetting and with discrimination between backfire and short circuit. In the field of extra high voltage various orders were carried out or are being executed. These orders consist of five 300 kW and nine 400 kW equipments for voltages between 10,000 and 15,000.

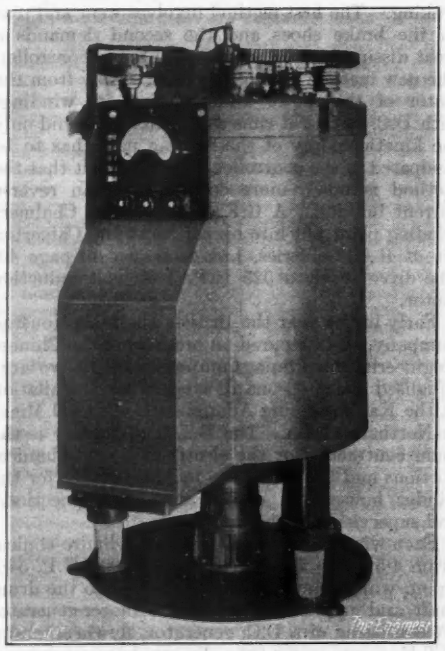
The English Electric Company, Ltd., also began to manufacture pumpless steel tank rectifiers during 1939. Many are reported to have been installed or are on order. Satisfactory sales have also been recorded of completely self-contained cubicle rectifiers first developed by the company four years ago. The 21–1500 kW steel tank rectifiers with associated transformers, switch and control gear for the sub-stations referred to in the company's 1938 review are now partly in service.

The success achieved by the General Electric Company's pumpless air-cooled steel-clad rectifier is shown by the demand from supply authorities, traction authorities, and industrial undertakings in many parts. Overseas countries for which rectifier units are being built include South Africa, South America, India, Australia, New Zealand, Denmark, Greece, and Spitzbergen. Development work continues and cylinders capable of giving 1000 amperes with overload ratings are now available with or without grid control. The grid control gear has been improved so that it gives a higher degree of reliability, smoother and more precise control, and quicker speeds of response.

Bruce Peebles and Co., Ltd. report that, although the demand for rectifiers was considerable, there was no falling off in the demand for converting plant. Orders received, and in some cases completed, include two 1500 kW motor converters for a public supply authority in India, a 1500 kW motor converter for a steel works in the Midlands; two 1000 kW synchronous induction motor generators for an Australian steel works; three 500 kW motor converters for an English steel works; two 250 kW motor converters for a London Power Company, and a 350 kW machine for a Government factory. Rectifiers orders received by this firm include one for a 1500 kW unit for an industrial works in England, and three 250 kW equipments for the Huddersfield Corporation.

Steel Works

A large amount of plant was constructed for the iron and steel industry. One of the more important contracts undertaken by the General Electric Company, Ltd., was for John Summers and Sons, Ltd. Some of the more interesting drives are for the slabbing mill auxiliaries, which consist of the tables, manipulator, screw down and shear drives which operate on the three-field generator system with power supplied from two synchronous motor generator sets with an individual generator for each of the drives. The shear drive is said to be one of the largest in this country. The whole duty cycle, consisting of acceleration, cutting, deceleration, and stopping at a predetermined fixed position, is completed in ten seconds. The



STEEL TANK PUMPLESS RECTIFIER

slabbing mill tables are divided into five sections individually controlled and driven by 46 motors operating on a 250 volt 3 phase supply obtained from a 385 kVA motor alternator set. The hot mill run out table consists of 131 rollers divided into two sections and each roller is driven by an individual variable speed motor obtaining its supply from two variable frequency sets giving 16·7/50 cycles and 134/440 volts, three phase. No fewer than 140 D.C. mill motors with outputs varying from 5 to 150 H.P. were put into service.

Of the G.E.C. rolling mill equipments being manufactured two of the most interesting are for tube mills one in Scotland and the other for Spain. In each case the principal drives are those for the piercer mill and the pilger mill, the former being driven by a geared induction motor and the latter by a D.C. motor with Ward Leonard control.

A heavy duty squirrel cage motor for driving a clay gun for stopping up the outlet of a blast furnace, (see page 40), was installed by the General Electric Company, Ltd., on one of the furnaces of Guest, Keen, and Baldwins Iron and Steel Company, Ltd. The clay gun has a 6¼in. bore and is 18ft. long. When plugging, the force developed behind the clay is approximately 35 tons. The motor is rated at 20 H.P., 550 r.p.m., and develops full load for half an hour with a temperature rise of 50 deg. Cent. in an ambient atmosphere of 45 deg. Cent. It is a high torque, high resistance machine, and when thrown on the line gives a starting torque equivalent to 1·57 times full load torque while drawing three times full load current. It can be stalled at full voltage for 20 sec., the maximum stalling torque being equal to 1·6 times full load torque. The specified duty cycle is as follows:—start against full load torque, run at full load torque for 3 min., stall for 15 sec., stop; stand for 15 min., reverse at full load torque, run at full load for 3 min. and stop.

The English Electric Company's rolling mill contracts included installations in this country and overseas. A 21,000 peak H.P. reversing blooming mill drive and a 20,000 peak H.P. three high rail mill drive were supplied to the Broken Hill Pty. Company, Australia. For the Bengal Iron and Steel Company, two 20,000 H.P. reversing equipments driving blooming and finishing mills respectively were put into service. Both these equipments were supplied complete with flywheel motor generator sets and control gear. For the Australian Iron and Steel Company, the English Electric Company supplied a 6000 H.P. slip-ring induction motor (see page 40), for a Morgan continuous billet mill and the associated D.C. edger motors.

One of the principal equipments completed for use in this country was the wide strip hot finishing mill for John Summers and Sons, where the English of Electric Company put into operation the whole the hot mill drives (see page 40), together with the necessary Ward Leonard motor generator sets aggregating 10,000 kW, an 18 panel 6·6 kV remote controlled switchboard, and all the control gear for this equipment together with that for the flying shear.

Reversing cold steel reduction mills, with the associated non-reversing temper pass mills, special constant tension reeling and all the auxiliary lines necessary in this type of cold reduction finishing plant, were completed and put into operation at the works of the Lancashire and Corby Steel Manufacturing Company. The year was noteworthy for the number of contracts received by the English Electric Company for Ward Leonard tandem continuous mill drives and reversing and non-reversing drives, of various types for hot and cold ferrous and non-ferrous rolling mills for installation at home and overseas.

Among the orders received by the British Thomson-Houston Company, Ltd., for rolling mill plant was one for a D.C. 3500 H.P. 187/375 r.p.m. motor for a sheet and strip mill. Control gear was included to provide Ward Leonard starting and speed control on this motor from an existing motor generator set. Another order was for two reversing mill equipments each comprising a D.C. reversing motor rated at 1350 H.P., 40/51 r.p.m. and a peak rating of 3900 H.P. Each motor is supplied from a flywheel motor generator set, consisting of a 1000 H.P. slip ring induction motor, a 1190 D.C. generator and a flywheel having a stored energy of 50,000 H.P. seconds. The order included all the auxiliary motors and control gear for the rolling mill. At the same works two 500 H.P., 490/980 r.p.m. D.C. motors were installed for driving non-reversing mills. A B.T.H. rolling mill equipment installed in Australia was started up early in the year. The plant comprises a 1250 H.P. 428 r.p.m. 6600 volt slip ring induction motor driving a hot sheet mill, a 500 H.P. 600 r.p.m. 440 volt slip ring induction motor driving a cold rolling sheet mill, and a 250 H.P. 300/600 r.p.m. D.C. motor driving a temper pass cold sheet mill.

The Metropolitan Vickers Electrical Company, Ltd., experienced a good supply of orders for non-ferrous mill equipments. At one plant the company installed a reversing non-ferrous mill equipment comprising an 860 H.P. (R M S) and 2150 H.P peak, 0/330/400 r.p.m. D.C. mill motor with a motor generator set and Ward Leonard control, and several additional non-reversing drives ranging from 120 to 330 H.P. complete with H.T. and L.T. switchgear, &c. A point of interest in the reversing mill equipment is the synchronising of the motors driving the working rollers at the back and front of the mill with the mill itself.

Another contract for a non-ferrous mill drive for export consisted of main mill drives totalling some 1325 H.P. of continuously rated motors for driving breaking down, sheet and strip aluminium mills. For steel works several large reversing mill equipments were ordered. The present demand for a greater output of steel billets has induced many firms to run their mills at higher speeds, and with this end in view one customer has requested the Metropolitan-Vickers Electrical Company, Ltd., to replace the existing Metrovick mill motor on a reversing bar mill by a machine to give the same output torque, but to run just over double the

speed of the existing motor, built in 1915. To provide the necessary increase in power supply to the new motor a third 1000 kW generator is being supplied to the original Ilgner set. Many other important rolling mill contracts were carried out by the Metropolitan-Vickers Electrical Company, but limitations of space preclude the possibility of dealing with them.

Hydro-Electric Plant

For the Electricity Supply Board, Dublin, the English Electric Company has secured a contract for the complete generating plant for the power stations at Pollaphuca and Golden Fall respectively on the River Liffey about twenty miles from Dublin. The contract includes a surge tower at the former station and the penstocks for both stations. The power stations will feed into the Electricity Supply Board's system and will link up with the present hydro-electric power station at Ardnacrusha, Limerick, and with the steam power station at Pigeon House, Dublin. Golden Fall station will be operated from Pollaphuca by means of remote control equipment.

The plant at Pollaphuca will comprise two 25,400 H.P. water turbines, operating at 250 r.p.m. under a head of 44·5 m., driving 18,750 kVA vertical alternators. At Golden Fall station, the plant will take the form of one 5750 H.P. vertical-reaction water turbine, running at 187·5 r.p.m. under a net head of 16·4 m. driving a 5000 kVA vertical umbrella-type alternator.

For the Waikaremoana power station of the Public Works Department, South Island, New Zealand, the English Electric Company has received a contract for two 28,000 H.P., 333 r.p.m. vertical reaction water turbines for working under a net head of 360ft. and for remote supervisory control.

For the Highbank Power Station (South Island) a contract has been received for a complete fully-automatic hydro-electric unit comprising a 36,000 H.P. vertical-shaft reaction water turbine, operating at 300 r.p.m. under 318ft. net head, coupled to a 28,000 kVA, 11,000 volt, 50 cycles, 3-phase vertical shaft umbrella-type alternator. The runner will be of solid stainless steel. Direct-coupled main and pilot exciters are to be fitted and standby exciters driven by a 300 H.P. impulse turbine are also to be provided. The contract includes cylindrical balanced main and relief valves, and the complete switchgear for the automatic control of the set. When completed this set will be the highest power turbine yet installed in New Zealand.

The Government of Tasmania Hydro-Electric Commission has placed a contract with the Company for two 21,000 H.P. four-jet horizontal impulse water turbines and alternators. The sets will operate at 428 r.p.m. under 940ft. net head and will drive 18,750 kVA, 11,000 volt, 50 cycles horizontal alternators, with main and pilot exciters. The turbines will each have two runners in one casing, each runner being actuated by two jets. Automatic oil pressure governors of the Company's standard type, together with cylindrical balanced main valves are included in the contract.

During the summer of 1939 the extensions to the Lochaber power station (see page 40) of the British Aluminium Company were completed. All the five new 10,000 H.P. sets are now in satisfactory operation. This station now contains 100,000 H.P. of English Electric water turbines and generators all under one roof and is the largest hydro-electric station in Great Britain.

The manufacture of the two 23,000 H.P. vertical water turbines and alternators ordered in 1938 by the Public Works Dept., New Zealand, for the Waitaki Power Station has been proceeding satisfactorily and erection has begun on site.

Electric Winders

The Metropolitan-Vickers Electrical Company, Ltd., carried out some interesting electrical work in mines. An electrification scheme is in the course of progress in a Lincolnshire ore mine where an output of 360 tons per hour will be obtained from a vertical shaft by means of skips. The equipment is automatic and no driver or brakesman is necessary. At the pit top the skips feed into a bunker from which an aerial ropeway conveys the ore to the furnaces. The Metrovick Company was the main contractor for the whole of the plant, including the shaft equipment and headgear. In Portugal a winder was converted from D.C. rheostatic control to Ward Leonard control with a flywheel equaliser set driven by a D.C. motor specially compounded to give automatic regulation. The complete contactor control includes automatic starting of the flywheel set. An increasing number of contracts were received for fitting the Metrovick patented dynamic braking system and special overwind protective gear to existing winders in this country and overseas.

Ward Leonard equipments completed by the English Electric Company range in size from small units up to a 7800 (peak) H.P. geared motor equipment for the Durban Roodepoort Mines of Rand Mines, Ltd. Following the completion of two Ward Leonard Winding equipments for Nundydroog Mines, Ltd., India, a duplicate equipment of 880 (peak) H.P. is now in hand for the Ooregum Gold Mining Company. A 668 (peak) H.P. winding equipment is in hand for the Victorian Railways for the State Coal Mines of Wonthaggi, Australia. Contracts for A.C. winding equipments received range in size up to a 3390 (peak) H.P. equipment operating at 6600 volts for the Durban Roodepoort Mines of the Rand Mines, Ltd. Smaller A.C. equipments were completed and put into operation in Australia.

Developments in the application of dynamic braking to A.C. winders formed the subject of considerable experiment at the General Electric Company's works. Although the first cost of the A.C. winder is less than that of a Ward Leonard controlled equipment its running costs are higher on account of the lack of regenerative braking characteristics, except when running above synchronous speed. The methods previously used for braking when the winder drum is pulled round by an unbalanced load have been : (1) the use of mechanical brakes, and (2) reverse power braking. The first method involves wear and tear on the brake shoes and the second demands a great dissipation of energy in the liquid controller. The new method cuts off the A.C. supply from the stator of the motor and energises its windings with D.C. so that it runs as an alternator and only the kinetic energy of the moving parts has to be dissipated in the controller, with the result that the method is much more economical than reverse current braking. A G.E.C. Fraser and Chalmers winding plant put into operation at the Calverton pit of B.A. Collieries, Ltd. is shown on page 40. The drive is by a 525 H.P. 3300 volt induction motor.

Early in the year the British Thomson-Houston Company, Ltd., secured an order from the Chinese Engineering and Mining Company, Ltd. for two large equalised Ward Leonard winders for installation at the Kailan Mining Administration's Coal Mines in Northern China. The B.T.H. Company is the main contractor for the electrical and mechanical portions and the order also includes cranes for the winder houses, all cables and interconnections, and supervision of erection at site.

Each winder includes a single bi-cylindro-conical drum 4·5 m. to 7 m., driven by a 3000 H.P. 54·8 r.p.m. winder motor coupled directly to the drum shaft, and supplied from a flywheel motor generator set consisting of a D.C. generator, flywheel, and a B.T.H. commutator type slip regulator equipment driven by a slip-ring induction motor having a synchronous speed of 750 r.p.m. When operating in conjunction with the slip regulator the induction motor has a speed range of 820 to 670 r.p.m. This type of slip regulator equipment gives the advantages of reduced energy consumption and power factor correction, and enables a smaller flywheel to be used.

The winders are operated by Ward Leonard control which incorporates a regenerative braking system which can be arranged to limit the rates of acceleration and retardation at any point in the shaft. As the winder drum is bi-cylindro-conical the control also provides for a slower rate of acceleration to be automatically imposed when re-starting a wind when the rope for the upcoming cage has started to climb the cone, or is being wound on the large diameter.

The winders are designed to wind a load of 3800 kg. of coal per trip at a speed of 20 metres per second. The coal is loaded in tubs which are raised in cages, and the output from one of the winders is 260 tons per hour from a depth of 475 m., and that of the other 220 tons per hour from a depth of 648 m. The B.T.H. Company also obtained an order from the New Consolidated Gold Fields, Ltd., for a 250 H.P. Ward Leonard Ilgner winder for the Konongo Gold Mines, Ltd., West Africa, complete with mechanical parts manufactured by Robey and Co., Ltd.

In the home market the outstanding order of the year was for a 1950 H.P. 6600 volt A.C. winder equipment for operation at one of the Wemyss Coal Company's collieries. It is a parallel drum winder for use with a balance rope and is designed for an initial duty of winding men and material from a depth of 1845ft. The order covers the complete electrical equipment, including the 6·6 kV switch and control gear, cables, and interconnections. The winder motor will be controlled by a set of 6·6 kV B.T.H. reversing contactors giving the breaks in series per phase and fitted with D.C. operating magnets giving smooth operation and small wear. This winder has special emergency braking arrangements and B.T.H. thrustors are fitted for tripping purposes.

Another order from the home market was obtained from the Powell Duffryn Associated Collieries, Ltd. for a 1250 H.P. 369 r.p.m. 3300 volt A.C. winder motor having a peak rating of 2600 H.P. This was required for driving an existing winder, illustrated on page 40, and was specially designed for mounting on the existing bed plate.

Trade Outlook for 1940*

THE trade problems and outlook of 1940 are of an entirely different character to those of 1939 and previous years ; we are at war. There is no question that the output from our Works will be less than that of 1939, in fact, it will be greater, but the character of the product will be changed.

Our first energies are being given to the all-important question of playing our part in assisting to bring the war to a successful conclusion as early as possible, and all the requirements that go towards this must take precedence over everything else.

Next comes the means of paying for overseas purchases. To this we are endeavouring to contribute by energetic action in the markets open to us overseas, and provided we get proper Government support to obtain the necessary materials there should be no difficulty in securing considerable business.

In addition, we are actively engaged in endeavours to obtain orders for British plant in markets that have hitherto been largely supplied by Germany. Given the necessary Government support this should produce satisfactory and far reaching results.

Big organisations, such as that with which I am associated, whose Personnel includes Scientists, Designing Engineers, Technicians, Experts in Production, and large numbers of skilled and semi-skilled employees, are working and co-operating loyally and enthusiastically, and are, in these times, a very great factor towards winning the war, their resources under proper management and co-operation with the Government can be expanded rapidly and effectively. We, with others, are making enormous efforts to this end, and therefore the volume of business handled in 1940 will obviously be satisfactory.

It is impossible to forecast the future, and although winning the war is our principal problem and duty, our next duty is undoubtedly to give some time to the consideration and organisation to deal with the problems with which we shall be faced when the war ends.

He would be an unwise man who attempted to forecast the tendency of business in 1940, other than that associated with the prosecution of the war.

Heavy Government spending must mean employment, but nobody should be allowed to forget that this heavy spending and big employment is not prosperity in the normal state of trade or development, but is associated with the destruction of both capital and material. Every economy, therefore, should be made to ensure wise spending and the elimination of waste, both in man's effort and in materials.

NEW BRIDGE ACROSS THE OKA.—Preparatory work has been commenced on the building of a new bridge across the River Oka at Kolomna, not far from Moscow. The new bridge, which is to replace the existing wooden bridge, will link up the town of Kolomna with the big industrial centre of Shchurovo. The length of the bridge with its approaches will be about a mile. It will rise 65½ft. above the river and its main span will be 505ft. long. The new bridge which is scheduled for completion in 1941 will cost 40 million roubles to build.

HARVESTING MACHINERY FROM AUSTRALIA.—The Government's Agricultural Emergency Scheme for increased production of foodstuffs in the United Kingdom is having a very salutary effect on Intra-Empire Trade. We understand that an arrangement has been made for a supply of harvesting machines (binders) from Melbourne, Australia. These particular supplies will help the Australian manufacturers concerned to pay for their constant heavy purchases of materials, &c., in this country, and will help this country to cope with the increased home crops, resultant from the Government's measures to put more land under the plough. Machines produced at home and in the Dominions will vie with each other more than ever in the increased grain fields of the Old Country in a friendly and truly Empire fashion and spirit. The impetus thus given to Intra-Empire Trade will, it is hoped, be of a lasting nature, and make our farmers less dependent on machinery imports from foreign countries.

* Mr. C. H. Nelson, Chairman and Managing Director, The English Electric Company, Ltd.

Markets, Notes and News

The prices quoted herein relate to bulk quantities. Unless otherwise specified home trade quotations are delivered f.o.t. Export quantities are f.o.b. steamer.

The Continental Steel Trade

The situation in the Continental iron and steel producing countries has been made difficult by wartime conditions. The French works are out of the market so far as export business is concerned excepting for deliveries to Great Britain which may be considered as part of the war arrangements between the allies. The requirements of the French Government in fact take up so much of the country's output that there is little surplus left to meet the demand from overseas markets. A system of control has been introduced by the French Government similar to that existing in Great Britain and appears to be working smoothly. At the outbreak of the war the coke situation in France caused some concern, but lately the position has become much easier as sufficient fuel is now being obtained from other countries to make good the absence of supplies from Germany. The Belgian industry allocates a certain proportion of its steel production for export, but the quantity seems entirely inadequate, and as the material is released it is quickly absorbed. Lately there has been some delay in releasing material as it is understood that the demands of the Belgian Government have been heavier than were expected. Cosibel, the Belgian steelworks' export organisation, has reported that it is out of the market. Luxemburg works also are finding it difficult to provide any important quantity for overseas trade. Trouble has arisen in the case of a number of the export markets over the request of the Belgian steelmakers to be allowed to increase prices against the balance of the orders on their books at the outbreak of war. Most overseas buyers strongly object to this course. The present current prices demanded by the Belgian and Luxemburg works are 25 per cent. to 30 per cent. above pre-war level, and well above the British official maximum quotations. The situation at the Belgian works is complicated by the difficulty of obtaining ore and fuel, and by the fact that the labour force is depleted by a large number of men having been called up for the Army. The arrangement for the supply of French ore to Belgium and the supply of semis by Belgium to Great Britain appears to have been put into operation. The supply of coke from Germany has been interrupted although during September and October normal quantities were apparently delivered. Export business is rendered more difficult by the demand by many of the works that confirmed credit shall be opened when the order is placed, and by the practice of the makers in the case of plates of quoting in dollars. For other steel materials quotations are made in francs.

The Pig Iron Market

Operations in the pig iron market have been fully resumed following the holiday break and the efforts of consumers to obtain deliveries of their requirements are as much in evidence as in the closing weeks of last year. The basic iron producers are making every effort to increase the output of this class of iron, and the whole of the current production is passing into immediate consumption. Distribution is carefully supervised and although supplies are barely equal to the demand consumers' urgent requirements are generally covered. It is probable, however, that the home output will be supplemented by imports from abroad. The situation in the foundry iron market is satisfactory, all things considered. Production is maintained at a high level, but on the other hand consumers' requirements are gradually expanding. The call for high phosphoric grades is not so insistent as for the low phosphoric iron, but the light castings industry, which is the principal user of the former, is becoming increasingly better employed. There are indications that the demand for high phosphoric foundry iron will expand, but at the moment it is probable that the output is able to take care of the needs of the market. There is steady pressure from consumers to obtain supplies of high phosphoric grades which are being used largely by the heavy engineering foundries and other branches of the engineering trade. Some stringency is noticeable in this department, but on the whole supplies of this description are more freely obtainable than seemed likely a few weeks ago. On the north-east coast, buyers' requirements of Cleveland iron are met from stocks at the blast furnaces and these have been greatly depleted. Apparently, the makers are now only serving their local customers. These supplies are also supplemented by considerable quantities of Midland irons. The careful regulation of deliveries, however, has avoided any hardship to the foundry trades in this district. Consumers in the Midlands have little to complain of in the way in which supplies are reaching them. There is talk in the market of an increase in the price of low phosphoric iron when the expected revision takes place, but it is not believed that the high phosphoric grades will be affected. The Scottish market has been quieter this week owing to the end of the year holidays, although these have been cut down to a minimum. The demand for foundry qualities has been irregular and is likely to remain so for a time, owing to the uneven distribution of work in the light castings industry. The position in the hematite market is unchanged: the demand is increasing, and stocks have now been materially reduced.

Scotland and the North

Most of the iron and steelworks in Scotland had resumed operations after the New Year break by the middle of last week. The opportunity was taken during the holidays to undertake repairs to plant which were badly needed as the machinery had been working under great pressure for many months. At the close of the year a number of important contracts were given out which were reflected in a heavy business in steel. For instance, the Scottish locomotive builders' share of the orders placed by the Ministry of Supply totalled one hundred locomotives and tenders. These with the business in hand, which includes orders for locomotives and boilers for the Federated Malay States, has placed that industry in a strong position and ensured work for several months. The waggon builders are also well employed, a feature of the position being the large number of orders for mineral waggons on hand which will involve the use of a considerable tonnage of steel. The requirements of the latter industry have also helped the bar iron producers, and this branch, which has been suffering from a shortage of work for many months, is now in a fairly sound condition. The shipyards have taken good quantities as well as the rivet and bolt trade. The main pre-occupation of the steelworks, however, is to meet the demand for plates and sections from the constructional engineering trades as well as the shipyards. Both these industries are fully employed upon Government contracts, and although the capacity of the steelworks has been stretched to the utmost the orders are getting into arrears. The re-rollers in Scotland are fairly well off as regards supplies of billets. Like the steelworks their order books are seriously congested, and their production is being immediately taken up. In the Lancashire market similarly active conditions prevail, and all branches of the steel industry are being pressed to accelerate supplies. The plate requirements of the tank and boiler makers have not diminished, and are likely to keep the mills well employed for a long time. The output of steel bars is on a heavy scale, but is insufficient to meet the full needs of the market and delivery dates are being extended. The sheet works continue to operate at capacity; but in some cases they are now in a position to accept orders of a commercial nature. Business in special steels continues to expand and many consumers are having to wait for supplies.

The North-East Coast and Yorkshire

Production on the north-east coast has been maintained at an exceptionally high level and few of the works ceased operations during the Christmas holidays. In spite of the large outputs, however, the makers are falling into arrears with deliveries, but this is not surprising considering the huge volume of orders which is being pressed upon them. There is a tendency now for the makers to adopt a reserved attitude towards fresh business. In these circumstances, licences are carefully scrutinised and there are reports that the advisability of instituting a comprehensive priority scheme is under consideration. Great efforts are being made to maintain the production of semi-finished steel; but consumers' requirements seem insatiable and the stringency which has ruled in this market for some time is still noticeable. Temporary relief was given in December by the distribution of some imported semis, but the quantities were not sufficient to bridge the gap between the home production and consumers' requirements. Fresh imports, however, are expected in the not distant future, and these should ease the situation The demands of the shipbuilding industry are difficult to cope with, and considerable tonnages of plates and sections are being absorbed by the yards on this coast. This demand is not likely to decline for a long time as the yards are fully employed. The requirements of the constructional engineers also show no signs of diminishing, and an astonishing tonnage of joists and sections of all sizes is moving into consumption. Most of the constructional firms supplied from this district are employed on important Government contracts, and their requirements are likely to be fully maintained for many months. Some slackening in the demand resulting from seasonal causes has been noticeable, but this is only temporary in character. The plate mills are working at capacity, and consumers do not find it easy to place orders for the required delivery. The Yorkshire steel industry is operating under great pressure. This is particularly noticeable in the semi-finished steel department, the demand for billets being in excess of the productive capacity of the works. The request is principally for soft basic billets, but the requirements of consumers of acid carbon billets are also expanding, and are in excess of production. Heavy tonnages of plates and sections are being turned out weekly and pass immediately into consumption. Business in alloy and special steels is reaching a high level, and in some branches supplies have become tight.

Overseas Trade Opportunities

The Department of Overseas Trade reports that the following contracts are open for tender. In all cases local representation is essential: Pretoria, Union Tender and Supplies Board: Supply and delivery of a portable petrol driven air compressor with a capacity of not less than 105 cubic feet per minute and capable of supplying compressed air to feed and satisfactorily operate two hand drills each operating at 80 lbs. per square inch at an altitude of 6000ft. (Pretoria, January 18th). Durban, City and Water Engineer's Dept.: Supply and delivery of quantities of copper buses, 2in., and couplings, ferrules, and stopcocks (Durban, January 19th). South African Railways and Harbours Administration: Supply and delivery of quantities of steel bars (flat, square, channel, and angle) (Johannesburg, February 12th); three locomotive boilers, fitted with steel fireboxes (Johannesburg, February 5th). Johannesburg, Public Works Dept.: Supply, delivery, and erection of air electric passenger lift for the General Post Office at Pretoria (Union Tenders and Supplies Board, Pretoria, February 1st). South African Railways and Harbours Stores Department: Supply and delivery of a turntable for 4-ton wharf cranes (Johannesburg, February 22nd).

Lead and Spelter

Conditions in the lead market do not appear to have changed, and with the general resumption of operations at the consuming works after the holidays, a heavy demand at once made itself felt The present quotation of £25 is regarded as a fair price, and no complaints on this score are heard. In fact, whilst such a huge proportion of the lead in this country is passing into consumption on work on Government account, the question of price obviously does not play an important part. If the Ministry of Supply raises or lowers the quotation it merely means that other departments using lead materials pay more, or less. Practically no export business is being transacted since all the lead in this country is required for the home manufacturers. The needs of the Continental makers are met by supplies from Mexico, and to some extent from the United States. Spain, which was formerly an important supplier, is now apparently requiring all the lead she can produce for the reconstruction work upon which she is engaged. The American market has become steady, and the demand has declined but the producers have sold so much forward metal that they are not inclined to press their products upon the market. . . . In the spelter market in Great Britain, steady conditions rule, and the Control seems well able to supply consumers of all classes with as much metal as they need. This points to full supplies of Empire material reaching this country since the demand is increasing rather than the reverse, notwithstanding that the galvanisers have worked off the bulk of their A.R.P. contracts. The industry, however, is now fully engaged upon other work which has made up for the completed orders. The brassmakers too are particularly busy upon orders for the Service departments. In the United States, which now acts as a barometer for the world trade in spelter, the market has lost its firmness, and the price has slipped back to 5·75c. If the import duty upon spelter is taken into account this makes the price in the United States equivalent to about £32 sterling. The question is being discussed as to whether if the demand continues to increase at its present rate it will be possible to satisfy it from Empire sources, and the general opinion is that this will present little difficulty. If necessary, spelter can also be obtained from Belgium although naturally there will be no foreign purchases if it can be avoided.

Copper and Tin

Quiet conditions are general in the copper market. Of course, with the Metal Exchange out of action the situation in this country is not clear, but as far as can be ascertained a considerable business is passing at the full maximum prices. The vast majority of users have practically their whole productive capacity occupied by war work but although it is not easy to obtain material for use for other purposes a small amount of copper seems to be available for work of a commercial character. No copper, of course, can be exported from Great Britain, but merchant firms are able to do a certain amount of business with approved countries and American producers. Export business in manufactured copper articles is also light, and apparently there is little material available, although some business has been done with overseas markets in copper tubes. Outside Great Britain the market has become easier, and although the American producers are retaining their quotation at 12.50c. f.a.s. for export, buyers are reluctant to pay this price. It is reported that Russia has failed to secure her copper requirements in the American market, and is now inquiring for 5000 tons of cartridge brass. Japan has also been a buyer. There does not seem to be much rough copper of good grade obtainable in this country, although it is a quality that is sought after. Copper of this description does not appear in the schedule of maximum prices, but it is understood that the Control sells at £58 per ton. . . . Conditions in the tin market since the year opened have been steady, but prices have shown a tendency to recede. The volume of supplies which has come forward since the market was freed has occasioned some surprise. Before the restrictions were removed, the market was limited to 25 tons per day, and the whole of this was absorbed by the demand for prompt metal. Consumers were, therefore, unable to buy forward, whilst at the same time until the export of tin was prohibited the high price in the United States attracted considerable quantities from this country. The restrictions upon dealing on the London Metal Exchange were removed without notice on December 11th, and the price promptly jumped about £40 to £272. This movement brought out large quantities of tin and the quotation receded to below £246. The contrast between the tonnages available at the higher price and those forthcoming at the Control price has naturally attracted the attention of the market, which is wondering whether previous to the removal of trading restrictions metal had been hoarded in the hope of an advance in price. According to Mr. W. H. Gartsen's statistics, the visible supply on December 31st was 25,020 tons, compared with 28,319 tons on November 30th. The monthly supplies in December were 13,057 tons against 10,137 tons in the previous month, whilst the deliveries were 16,356 tons compared with 12,513 tons.

NIAGARA FALLS POWER PLANT PLANS.—According to Dr. T. H. Hogg, chairman and chief engineer of the Ontario Commission, construction of a new and modern power-generating plant in the Niagara system by the Hydro Electric Power Commission of Ontario would result from the revision of the international treaty now governing the use of water at Niagara Falls. Such a plant would increase the efficiency of the utilisation of the water diversion allotted to Canada. Plans now before President Roosevelt's "National Power Policy Committee" include revision of the treaty negotiated in 1908. It is stated that of the 36,000 cubic feet a second which Canada is allotted for power purposes under the treaty, only about 16,000 cubic feet a second are employed at the highest efficiency with the present machinery and equipment. If the treaty is rewritten, it will give the Ontario Commission the right to new development, according to reports.

French Engineering Notes

(From our own Correspondent in Paris)

Carbonite

The fuel for portable suction gas producers known as "Carbonite" was developed as the result of researches at the national explosives laboratory at Servan-Livry. It came into public notice about two years ago as a standard fuel which was to be manufactured by the State in a number of works all over the country, so that in each large area there would be an abundant and easily distributed supply of fuel. If the State undertook to monopolise the manufacture of a standard fuel it was because there appeared to be no other way of getting to a direct solution of the problem without going through a long period of experimental work that may weaken the faith of car owners in the practical success of the suction gas plant at a time when the transformation of lorries and cars to run on suction gas admits of no delay. It was a mistake to suppose that a suction gas vehicle could run satisfactorily on any kind of cheap fuel. Charcoal can alone be relied upon in the absence of good anthracite to give favourable results on lorries in the hands of suitable drivers, but the fuel is bulky and needs a large generator, while the plant requires frequent attention. The Minister of Public Works continues to insist upon the use of charcoal as a fuel that is immediately available, and the question of supply and distribution is being thoroughly investigated. Manufacturers of portable producers now generally specify particular fuels. It is only by designing the suction gas plant for the particular fuel that satisfactory results can be obtained. Since the use of charcoal is practically limited by its bulk, an alternative fuel was found in small briquettes, such as ground charcoal compressed with a binding material. This ingredient may introduce a percentage of tar that is sufficient to cause trouble, and the object of the national explosives laboratory was to find a binding material free of anything that may complicate producer design. In default of any other positive solution, the Government has made a start with its plans for manufacturing and distributing a standard fuel, for which purpose a works is being installed at Sisteron, in the Basses-Alpes. Whether this will be immediately followed by the construction of similar works elsewhere is uncertain. Meanwhile, a campaign has been launched in favour of the compulsory use of carbonite for suction gas vehicles employed in the Government and War services and to encourage makers of producers to design types of plants for the exclusive use of carbonite. There is no attempt to belittle private research work so long as it cannot be said that the State product is the last word in producer fuels. It has long been used satisfactorily in small producers, but it remains to be seen whether the cost of charcoal will not be increased unduly by mechanical treatment. On the other hand, it may be possible to off-set the higher fuel cost by simplifying the producer plant between the generator and the engine. Except as a war expedient, the Government can hardly launch a monopoly of this kind until the commission on gas producers and fuel supplies has completed its inquiry, the conclusions of which will almost certainly be opposed to any fuel monopoly.

Shipbuilding

The pressure on shipyards for naval construction is so heavy that builders had to take stock amongst themselves of the possibilities of constructing merchant ships preliminary to the drawing up of a programme which the Minister of the Merchant Marine was anxious to put in hand immediately. Before the mobilisation, the yards were employed upon executing the programme for modernising the merchant fleet and were required to build 75,000 tons of shipping a year for a period of seven years. This work was necessarily suspended in order that the entire shipbuilding resources could be utilised, as far as possible, to accelerate the naval shipbuilding programme. The smaller shipyards have orders for light craft, but there is still a margin for the construction of merchant shipping which it is hoped to increase. Fortunately, the reorganisation of the shipbuilding industry at the time of the crisis several years ago had greatly increased its capacity with, recently, the introduction of more efficient methods of work, so that builders were ready to deal with the pressure of naval construction when the war broke out and are now prepared to construct ships that are urgently needed to supply the country with raw materials and commodities. The work is greatly accelerated by the removal of restrictions on working hours. The Minister of the Merchant Marine has, therefore, put in hand a programme for the building of four colliers of 4700 tons, thirteen colliers of 3500 tons, four colliers of 2650 tons, two oil tankers of 18,000 tons, and a number of cargo ships. It also includes more than a hundred fishing boats, with trawlers of 600 tons.

Collapse of Cast Iron Bridge

The bridge connecting the Ile Saint-Louis and the Ile de la Cité collapsed on December 22nd, carrying with it a number of people, of whom four or five lost their lives from drowning. These two islands in the centre of Paris are separated by a channel nearly 200ft. wide, joining the arms of the river on each side. It was spanned by a cast iron bridge built in 1861. The arch members were of oval section in two parts with bolted flanges. There were nine of these members attached at their extremities by bolts sunk in shallow recesses in the stone embankments. Stanchions and panels with four rectangular openings supported the platform. The channel has currents that require careful navigation, and there had already been three recent collisions of barges with the bridge, partly in consequence, it is said, of experienced bargemen having been replaced owing to mobilisation by others with insufficient knowledge of this particular stretch of waterway. On the present occasion, a petrol tanker bore against the bridge which broke in the middle, and the two halves turned over with a shearing of the abutment bolts. The entire bridge disappeared completely in the channel. The weakness of the bridge for the traffic had long been apparent, and the maximum load carried over it had been reduced. It is now a question whether it will be replaced by a footbridge or by a road bridge of reinforced concrete.

British Patent Specifications

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

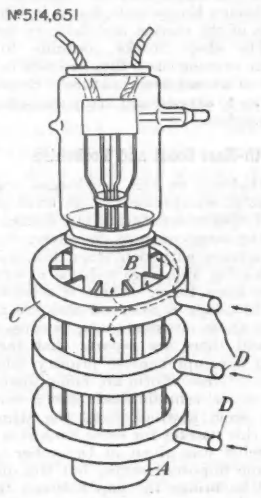
Copies of Specifications may be obtained at the Patent Office Sales Branch, 25, Southampton Buildings, Chancery Lane, W.C.2, 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

ELECTRICAL APPLIANCES

514,651. May 12th, 1938.—AIR-COOLED THERMIONIC VALVES, The M-O Valve Company, Ltd., of Marconi Offices, Electra House, Victoria Embankment, London, W.C.2, Donald Arthur Boyland, and Robert Le Rossignol, both of Research Laboratories of The General Electric Company, Ltd., Wembley, Middlesex.

Hitherto thermionic valves controlling more than 10 kW have usually been cooled by water or other liquid; forced air-cooling has been confined to smaller valves. But the advantages of air over water-cooling are very great, especially in valves operating at high frequencies much exceeding 1 Mc. Air-cooling has not been used for large valves, mainly because the power required to establish the necessary flow of air has been undesirably great. The object of this invention is to reduce the power required. According to the invention, a thermionic valve of the type specified comprises, as integral parts, a plurality of apertures A adapted to be connected in multiple to a blower (or suction pump) and one or more apertures B through which

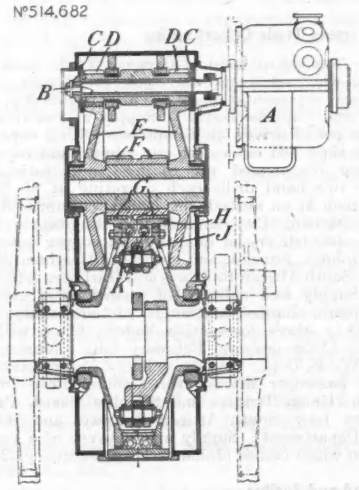


air flowing in (or out) through the said apertures A can flow out (or in), the passages connecting the said apertures A to the aperture(s) B being such that the stream entering (or leaving) each said aperture A cools part only of the anode and that all these streams together cool the whole anode but are not geometrically parallel streams. The terms "blower" and "suction pump" in the foregoing statement imply nothing about the mechanical construction of these articles; they mean merely means for causing air to enter or leave the entrance aperture. In the example of the invention illustrated, the anode A carries radial fins B. Annular channels C open towards the anode, surround the anode, a space being left between the channels. Each channel carries a nozzle D, so that air blown into the nozzle flows (as shown by the dotted lines) round the channel and into the spaces between the fins, issuing finally either at the ends of the fins or through the spaces between the channels. Each stream entering a nozzle D cools all the fins and each fin is cooled by all the streams which enter the nozzles; but the streams are not geometrically parallel streams.—*November 14th*, 1939.

LOCOMOTIVES

514,682. April 12th, 1938.—SPEED REDUCTION GEARS FOR TURBINE DRIVEN LOCOMOTIVES, *Aktiebolaget Ljungstroms Angturbin, Kungsgatan, 32, Stockholm, Sweden*), William John Tennant, 111–112, Hatton Garden, London, E.C.1.

An embodiment of the invention is illustrated in the accompanying drawing. Between the locomotive frames is a gear



box which contains the two-stage reduction gear. The locomotive turbine A is mounted outside the frame, and has connected to its shaft an intermediate hollow shaft B which is connected to two flexible diaphragm couplings C C and thereby effects a flexible transmission between the turbine shaft and the high speed gear pinions D D. These pinions are made in one piece with their shaft which is mounted in bearings arranged between the pinions. The first speed reduction gear further comprises two gear wheels E E meshing with the pinions D D and secured to a hollow shaft which carries the pinions F F of the second reduction gear. The pinions F are manufactured from a single ring and are in mesh with two gears G G, formed on a common rim. The rim of the low speed gear wheel of the secondary gear consists of two separate co-axial rings H J, between which there are arranged helical springs K, which permit of a slight relative movement between the rings and thus serve to prevent transmission of shocks from the low speed gear wheel to the high speed gearing. To take up any relative movement between the engine frame and the driving axle, the drive from the low speed gear wheel to the driving axle is effected by a series of floating links of known construction.—*November 15th*, 1939.

Forthcoming Engagements

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Monday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

Institution of Automobile Engineers

Tuesday, Jan. 16th.—London Graduates. 12, Hobart Place, S.W.1. Discussion "Fuel for Road Vehicles in the Year 2000." 7 p.m.

Wednesday, Jan. 17th.—N.W. Centre. Engineers' Club, Albert Square, Manchester. "Accidents," H. Strange. 7.15 p.m.

Institution of Electrical Engineers

Tuesday, Jan. 23rd.—Scottish Centre. Royal Technical College, Glasgow, C.1. Chairman's Address, S. Parker Smith. 6.30 p.m.

Thursday, Jan. 25th.—Savoy Place, Victoria Embankment, W.C.2. "Fire-Fighting Equipment for Electrical Installations," H. W. Swann, J. Hacking, and R. A. McMahon. 6 p.m.

Institution of Engineers and Shipbuilders in Scotland

Tuesday, Jan. 23rd.—39, Elmbank Crescent, Glasgow. "Effect on the Propulsion of a Single-Screw Cargo Vessel of Changes in the Shape and Dimensions of the Propeller," J. L. Kent and R. S. Cutland. 6.30 p.m.

Institution of Mechanical Engineers

Friday, Jan. 19th.—Storey's Gate, Westminster, S.W.1. Hawksley Lecture. "A Review of Forty Years' Development in Mechanical Engineering Plant for Power Stations," Sir Leonard Pearce. 3 p.m.

Saturday, Jan. 13th. Yorkshire Branch. Hotel Metropole, Leeds. "Mechanical Engineering Practice at Modern Collieries," J. Stafford.

Institution of Production Engineers

Tuesday, Jan. 23rd.—Mostyn Hotel, Portman Square, W.1. "The Use of X-Rays in Inspection Methods," G. E. Bell. and "Inspection by Optical Projectors," W. G. Ridge. 7.30 p.m.

Junior Institution of Engineers

To-day, Jan. 12th.—39, Victoria Street, S.W.1. "The Engineer and Salesmanship," R. Gillespie Williams. 6.30 p.m.

Saturday, Jan. 20th.—Midland Section. James Watt Memorial Institute, Birmingham. "Recent Developments in the Use of Town's Gas and other Gases for Traction Purposes," C. M. Walter. 2.30 p.m.

Friday, Jan. 26th.—39, Victoria Street, S.W.1. "The Advantages accruing to Forced Circulation Boilers," R. E. Trevithick. 6.30 p.m.

Manchester Geological and Mining Society

Tuesday, Jan. 16th.—Queen's Chambers, 5, John Street, Manchester 2. "The Introduction and Use of Steel Roof Supports at the Working Face," J. F. Carr. 2.30 p.m.

North-East Coast Institution of Engineers and Shipbuilders

To-day, Jan. 12th.—Mining Institute, Newcastle-upon-Tyne. "The Application of the Photo-Electric Cell in Industry," J. B. Kramer. 6 p.m.

Royal Institution of Great Britain

Wednesday, Jan. 17th. 21, Albermarle Street, W.1. "The Theory of Nuclear Forces," R. Peierls. 5.15 p.m.

Friday, Jan. 26th. 21, Albermarle Street, W.1. "Long Distance Broadcasting," Sir Noel Ashbridge. 5 p.m.

Royal Society of Arts

Wednesday, Jan. 17th.—John Street, Adelphi, W.C.1. "Applications of X-Ray Technique to Industrial Problems," H. P. Rooksby. 2.30 p.m.

CALENDARS AND DIARIES

ASHWELL AND NESBIT, Ltd., Barkby Road, Leicester. Wall calendar with daily tear-off sheets.

BENNIE LIFTS, Ltd., 2, Tinworth Street, S.E.11. Wall calendar with daily tear-off sheets.

BRITISH JEFFREY DIAMOND, Ltd., Wakefield. Wall calendar.

COLTON ELECTRICAL EQUIPMENT COMPANY, Ltd., 198, Blackstock Road, London, N.5. Wall calendar and wire table.

HACKBRIDGE ELECTRIC CONSTRUCTION COMPANY, Ltd., and HEWITTIC ELECTRIC COMPANY, Ltd., Walton-on-Thames, Surrey. Refill for desk engagement memorandum pad.

HOLMAN BROTHERS, Ltd., Camborne. Wall calendar.

WILLIAM JESSOP AND SONS, Ltd., Brightside Works, Sheffield. Pocket Diary.

RANSOMES AND RAPIER, Ltd., Waterside Works, Ipswich. Pictorial wall calendar showing past, current, and next months.

ROBEY AND COMPANY, Ltd., Lincoln. Wall calendar showing current, past, and next month.

HENRY SIMON, LTD., Cheadle Heath, Stockport. Wall calendar with daily tear-off sheets.

STANTON IRONWORKS COMPANY, Ltd., Stanton by Dale, Nottingham. Pocket Diary.

S. S. STOTT, Ltd., Haslingden, Rossendale, Lancs. Wall calendar.

JOHN I. THORNYCROFT AND COMPANY, Ltd., Thornycroft House, Smith Square, London, S.W.1. Wall calendar.

JOHN TULLIS AND SON, Ltd., St. Ann's Works, Glasgow, S.E. Desk memo pad and calendar.

E. R. AND F. TURNER, Ltd., Foxhall Works, Ipswich. Wall calendar showing past, current, and next months.